

K51211890008



REPLY TO
ATTENTION OF

DEPARTMENTS OF THE ARMY AND THE AIR FORCE
NATIONAL GUARD OF KANSAS
ADJUTANT GENERAL'S DEPARTMENT
DIRECTOR OF FACILITIES ENGINEERING
131 SOUTHWEST 27TH STREET
TOPEKA, KS 66611-1159



February 28, 1995

RECEIVED

MAR 06 1995

Environmental Protection Agency
Superfund Branch
Site Assessment & Federal Facilities Section
ATTN: Ms. Vickie Clarrey
726 Minnesota Avenue
Kansas City, Kansas 66103

**SPFD BRANCH
REGION VII**

Kans Nat'l Guard Armory
K51211890008
1.5
2.28.95

Dear Ms. Clarrey:

Enclosed is a copy of the Kansas Army National Guard Preliminary Assessment (PA) for the armory, the Organizational Maintenance Shop number seven (OMS-7), and the parking lot located at 100 S 20th St, Kansas City, Kansas.

If you have questions or comment regarding this PA, please contact Mr. Sam Mryyan in our environmental office at 913-274-1154.

Sincerely,

William W. Vonderschmidt
Colonel, Kansas Army
National Guard
Director of Facilities Engineering

Enclosure

Copy Furnished:

Kansas City Public Library
KDHE - Topeka Office
KDHE - Lawrence Office

30356136



Superfund

PRELIMINARY ASSESSMENT
FOR
KANSAS ARMY NATIONAL GUARD
THE ORGANIZATIONAL
MAINTENANCE SHOP NO. 7
LOCATED AT
KANSAS CITY, KANSAS

Prepared by: Kansas Army National Guard
Adjutant General's Department
Director of Facilities Engineering
131 Southwest 27th Street
Topeka, KS 66611-1159



REPLY TO
ATTENTION OF

DEPARTMENT OF THE ARMY
U. S. ARMY ENVIRONMENTAL HYGIENE AGENCY
ABERDEEN PROVING GROUND, MARYLAND 21010-5422



EXECUTIVE SUMMARY
PRELIMINARY ASSESSMENT NO. 38-26-K33X-94
KANSAS CITY ARMY NATIONAL GUARD ARMORY
THE ORGANIZATIONAL MAINTENANCE SHOP NO. 7
AND THE PARKING LOT
KANSAS ARMY NATIONAL GUARD
7-11 MARCH 1994

1. PURPOSE. The U.S. Army Environmental Hygiene Agency (USAEHA) performed a preliminary assessment (PA) at the Kansas City Army National Guard (KCARNG) Armory during 7-11 March 1994. This PA included the armory, the organizational maintenance shop No. 7 (OMS-7), and the parking lot. This particular PA was required since the KCARNG Armory and its parking lot were listed on the U.S. Environmental Protection Agency's (EPA's) Hazardous Waste Compliance Docket Number 8, published in October 1993. Under EPA policy, each facility included on the docket must complete a PA within 18 months of publication of the notice. A PA is an investigation to collect readily available information and conduct a site reconnaissance. The PA is designed to determine if a site poses a threat to human health and if the site requires further investigation.

2. CONCLUSIONS.

a. Six soil samples, collected in July 1984 from the slopes of the landfill, were analyzed for metals and for base/neutral organic compounds. Chemical analyses indicated that some metals and organic compounds generally contained higher analytical results than those detected in the background samples. In August 1984, the Kansas Department of Health and Environment (KDHE) installed four ground-water monitoring wells in the vicinity of the KCARNG site. Ground-water samples collected in 1985 were contaminated with metals and polycyclic aromatic hydrocarbon (PAH) compounds. Some of the metals detected exceeded the National Primary Drinking Water Regulation (NPDWR), (i.e., antimony, barium, beryllium, chromium, lead, and nickel).

b. Although this preexisting landfill has a history of leachate problems, no further investigation by the Army is recommended at this time. The landfill was operated by the city and then by Owens-Corning Fiberglass Corporation, not by the Army. Because of its location, there is no possibility of constructing downgradient (and possibly upgradient) ground-water monitoring wells within the military boundary without penetrating the waste itself. If further investigation is deemed appropriate in the future, the approach must be coordinated among Region VII of the EPA, the KDHE, the Army National Guard, and other past and present landowners.

c. In 1985, all residences within a 3-mile radius of the KCARNG site either used city-supplied drinking water or used bottled drinking water; therefore, ground water was not used for drinking water. However, limited use of springs or ponds may have occurred in some areas. The nearest known ground-water well being used in 1985 was a 35-foot deep irrigation well located about 3 blocks east of the KCARNG site. Five, 60- to 100-foot deep industrial wells, completed in the Kansas River alluvial aquifer, are located south of the KCARNG site.

d. In the past, contaminated soil from small leaks and spills from the storage of fuel, fuel additives, and solvents occurred at or near a small metal storage cabinet in the southwest corner of the motor vehicle storage compound (bullpen).

e. Two 2,000-gallon underground storage tanks (USTs) and one 300-gallon UST were located inside the bullpen. Fuel was spilled around these USTs; however, the contaminated soils were removed when these three USTs were removed.

f. Some friable asbestos was found around the heating pipes in the boiler room of the armory and also within the OMS-7. No information in the files indicates that any additional asbestos inspection or asbestos remediation had occurred since the last inspection in 1990.

g. The indoor firing range and the bullet-trap sand in the KCARNG armory, which apparently is no longer in use, contains lead and lead dust.

3. RECOMMENDATIONS.

a. Remove contaminated soil around the outdoor storage cabinets that exhibit evidence of past fuel and solvent leaks and/or spills. Using a backhoe, remove the contaminated soil to about a 1-foot depth. Check the remaining soil for staining, and if stains are still present remove more soil until the soil appears clean. Then test a few soil samples from the base of the excavation for volatile organic compounds and total petroleum hydrocarbons to document satisfactory remediation.

b. Perform an assessment of all known and suspected friable and nonfriable asbestos according to Chapter 10 of Army Regulation (AR) 200-1 (dated 23 April 1990).

c. Establish a comprehensive and effective asbestos management program and plan following Department of the Army (DA) guidance.

d. Comply with all applicable Federal, State, local, and/or DA regulations relative to asbestos management and/or remediation.

e. Test the lead and lead dust from the indoor firing range for toxicity characteristics leaching procedures (TCLP) and for total lead, and if appropriate, the lead should be removed and treated as hazardous waste.

f. Remodel and upgrade the indoor firing range, if it is to be used again, to prevent potential high levels of airborne lead dust.

CONTENTS

Paragraph	Page
I. REFERENCES	1
II. AUTHORITY	1
III. PURPOSE	1
IV. GENERAL	1
A. Personnel Contacted	1
B. U.S. Army Environmental Hygiene Agency (USAEHA) Survey Personnel	1
V. BACKGROUND	2
A. Location	2
B. Topography and Drainage	2
C. Climate	2
D. Historical Geology Summary Within the Area From Topeka to Kansas City, Kansas	5
E. Local Geology in the Immediate Area of the KCARNG Armory, the OMS-7, and the Parking Lot	7
VI. FINDINGS AND DISCUSSION	7
A. Reason for this Preliminary Assessment	7
B. Description of the Landfill Below the OMS-7 and the Parking Lot	9
C. KDHE Hazardous Waste Compliance Inspection	24
D. Current Hazardous Waste Storage and Hazardous Waste Sources at the KCARNG Armory, the OMS-7, and the Parking Lot	25
E. Underground Storage Tanks (USTs)	26
F. Asbestos	27
G. Lead Found in the Indoor Firing Range	28
H. Arms Vault Seepage	29
VII. CONCLUSIONS	29
VIII. RECOMMENDATIONS	30
Appendices	
A - REFERENCES	A-1
B - PERSONNEL CONTACTED	B-1
C - LATITUDE AND LONGITUDE CALCULATION WORKSHEET BY USE OF AN ENGINEER'S SCALE	C-1
D - TECHNICAL ASSISTANCE	D-1



REPLY TO
ATTENTION OF

DEPARTMENT OF THE ARMY
U. S. ARMY ENVIRONMENTAL HYGIENE AGENCY
ABERDEEN PROVING GROUND, MARYLAND 21010-5422



HSHB-ME-SG

PRELIMINARY ASSESSMENT NO. 38-26-K33X-94
KANSAS CITY ARMY NATIONAL GUARD ARMORY
THE ORGANIZATIONAL MAINTENANCE SHOP NO. 7
AND THE PARKING LOT
KANSAS ARMY NATIONAL GUARD
7-11 MARCH 1994

I. REFERENCES. See Appendix A for a list of references.

II. AUTHORITY.

A. AEHA Form 250-R, NGB, 22 December 1993.

B. Memorandum, NGB, NGB-ARE, 23 December 1993, subject: Transmittal of U.S. Army Environmental Hygiene Agency Mission Service #38 Request from Kansas Army National Guard (KSARNG).

III. PURPOSE. The purpose of this survey was to perform a preliminary assessment (PA) at the Kansas City Army National Guard (KCARNG) Armory, the Organizational Maintenance Shop No. 7 (OMS-7), and the parking lot. This particular PA is required since the KCARNG Armory and its parking lot were listed on the U.S. Environmental Protection Agency's (EPA's) Hazardous Waste Compliance Docket Number 8, published in October 1993. Under EPA policy, each facility included on the docket must complete a PA within 18 months of publication of the notice. A PA is an investigation to collect readily available information and conduct a site reconnaissance. The PA is designed to determine if a site poses a threat to human health or requires further investigation.

IV. GENERAL.

A. Personnel Contacted. Appendix B provides a list of personnel contacted during this PA.

B. U.S. Army Environmental Hygiene Agency (USAEHA) Survey Personnel.
Mr. David C. Bayha, Hydrologist, Waste Disposal Engineering Division (WDED).

V. BACKGROUND.

A. Location.

1. The KCARNG Armory, the OMS-7, and the parking lot are located in northeastern Kansas, within Kansas City, in the eastern part of Wyandotte County, Kansas, in the NE 1/4 of the NE 1/4 of the NE 1/4 of Section 17, Township 11 South, Range 25 East (NE NE NE Sec. 17, T.11 S., R.25 E.). The northeast corner of the OMS-7 is at latitude 39° 06' 3.1", longitude 94° 39' 5.8" (Appendix C). Wyandotte County is bounded on the north and west by Leavenworth County Kansas, on the north and east by the Missouri River, on the east by Jackson County, Missouri, and on the south by Johnson County and the Kansas River. The armory, OMS-7, and the parking lot lie within the highlands north of the Kansas River valley. The Kansas River, which flows towards the east-northeast, joins the Missouri River about 2.5 miles north-northeast of the KCARNG Armory (references 1 and 2).

2. The KCARNG Armory property is bounded on the east by 18th Street (State Route 58), on the north by Ridge Avenue, on the south by the Lowell Avenue right-of-way, and on the west by 22nd Street (Figures 1 and 2). Residential and a few small commercial properties immediately surround this site; however, industrial sites are within 0.75 to 1 mile south and downgradient from this site (reference 1). The address of the KCARNG Armory in Kansas City, Kansas is: 100 South 20th Street, Kansas City, KS 66102-5604. The State Headquarters of the Kansas Army National Guard and the State Adjutant General are located in Topeka, Kansas and their address is: 131 Southwest 27th Street, Topeka, KS 66611-1159.

B. Topography and Drainage. The elevation of the KCARNG Armory, the OMS-7, and the parking lot ranges from a little above 900 feet to about 860 feet above sea level. Surface drainage from the armory site flows south-southwest and then south towards the Kansas River (Figure 1) (reference 1).

C. Climate. Temperatures during the spring (i.e, March to May) are mild and range from 42 °F to 70 °F and average 54 °F. The temperatures during the summer (i.e., June to August) range from 75 °F to 80 °F and average 77 °F; however, it is usually quite humid. The temperatures during the fall (September and October) are comfortably mild, and range from 59 °F to 70 °F, and average 65 °F. Winter temperatures (during November to February) range from 30 °F to 43 °F and average 35 °F. The normal annual total precipitation is about 35 inches based on the period from 1931 to 1960. The higher precipitation occurs during May and June and the lower precipitation is during December, January, and February (reference 3).

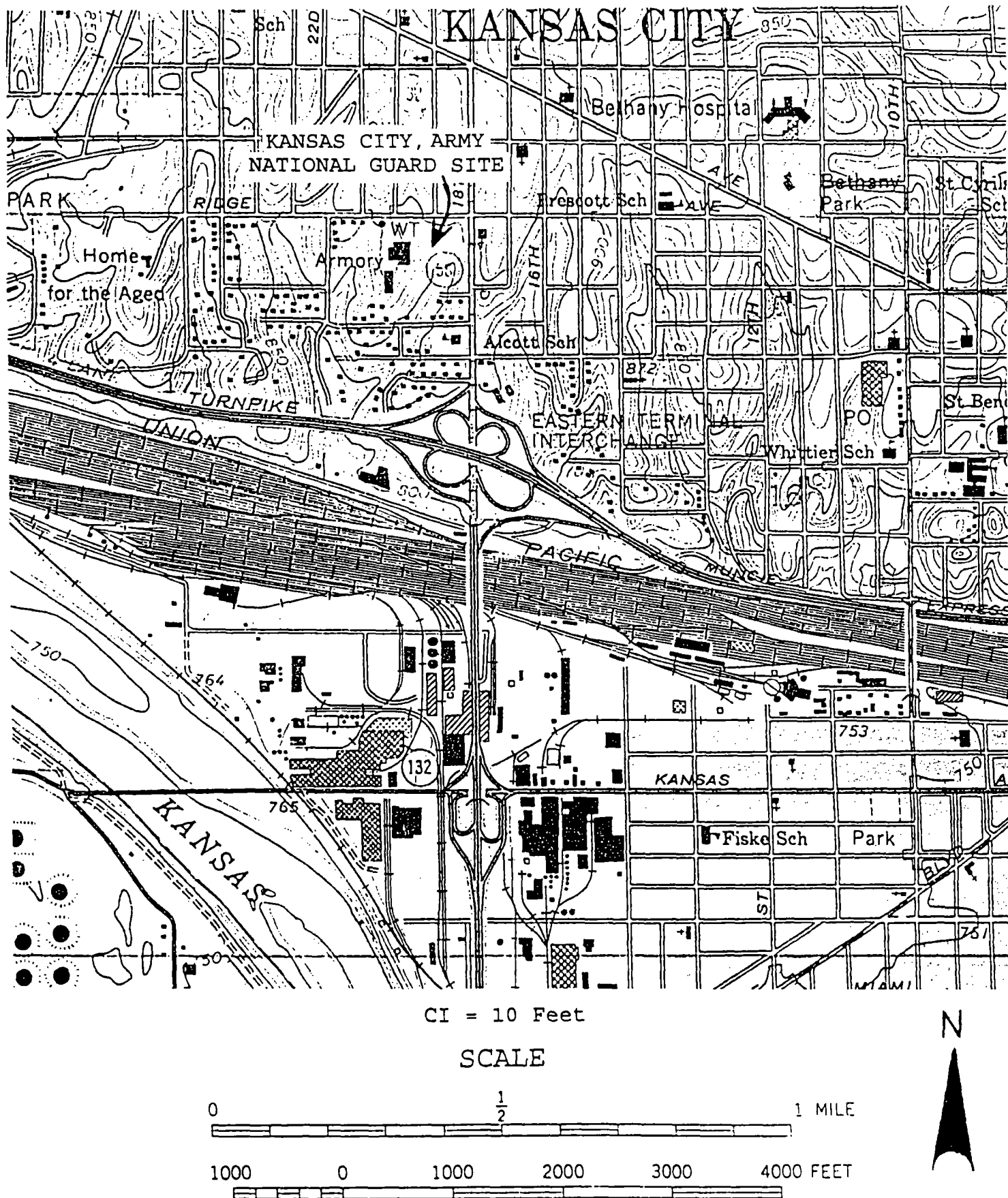
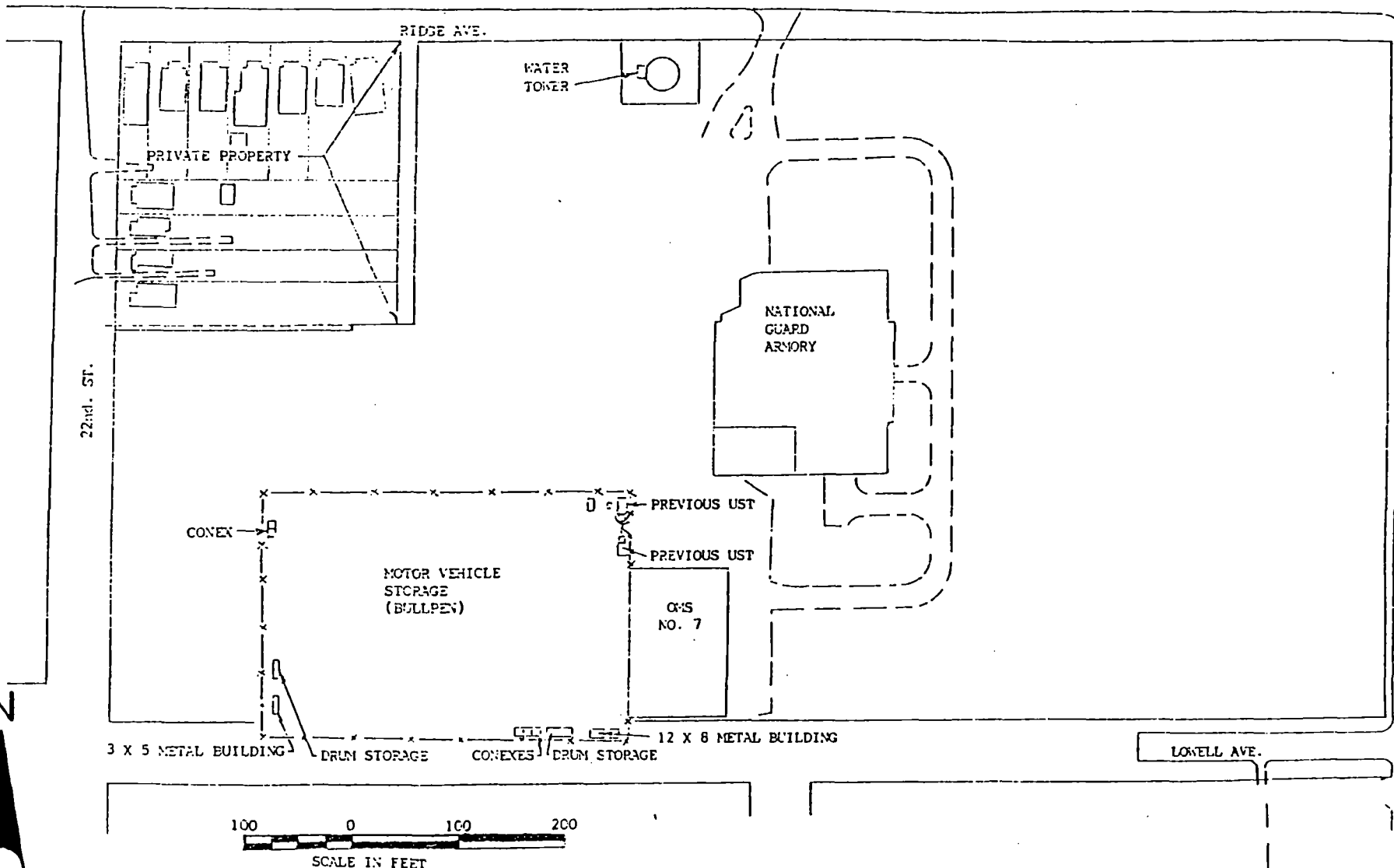


FIGURE 1. MAP SHOWING LOCATION OF THE KANSAS CITY, KANSAS ARMY NATIONAL GUARD SITE



US ARMY ENVIRONMENTAL HYGIENE AGENCY
WASTE DISPOSAL ENGINEERING DIVISION
ABERDEEN PROVING GROUND, MARYLAND

FIGURE 2. MAP SHOWING THE BOUNDARIES OF THE KANSAS
ARMY NATIONAL GUARD SITE, THE ARMORY, OMS-7,
AND THE MOTOR VEHICLE STORAGE COMPOUND

DRAWN BY

PROJECT NO

FILE

D. Historical Geology Summary Within the Area From Topeka to Kansas City, Kansas.

1. Bedrock. The bedrock is generally composed of alternating layers of dissected limestone, shale, and sandstone of Upper Pennsylvanian age ranging between 2,000 to 3,000 feet in thickness. These individual rock layers, which have been assigned to the Kansas City, Lansing, Douglas, Shawnee, and Wabaunsee Groups, in ascending order from oldest to youngest, are nearly horizontal and crop out from east to west. Although slight tilting and fracturing of the rock layers have occurred since their deposition, the region is presently considered to be structurally stable (references 2 and 4).

a. The individual limestone layers range in thickness from less than 1 foot to more than 25 feet. The layers may be blocky to thin, wavy, and/or uneven. The limestone often contains fossils, flint, secondary minerals, or voids. It may be relatively pure in chemical composition [i.e., all calcium carbonate (CaCO_3)]; however, it may also contain varying amounts of silt and clay. Solution of the limestone, by ground water, may enlarge existing cracks and form sinkholes. Hillside seeps and/or springs may occur during wet periods where the limestone is close to or intersects the surface (references 2 and 4).

b. Shale, which is composed primarily of silt and clay minerals, may contain differing amounts of sand, and ranges in thickness from a few inches to about 100 feet. Animal and plant fossils may be locally profuse, but generally, fossils are not common. Steep slopes are subject to natural, very slow downslope movement of the layer of mantle above the shale surface; however, this movement may increase when the mantle becomes saturated. Failure of this material to support heavy weight is common (references 2 and 4).

c. The sandstone beds range in thickness from less than 1 foot to about 120 feet. Cross-bedding may be present, indicating the manner of deposition (i.e., by water or wind). The sandstone beds are composed of very fine to coarse sand grains, commonly cemented by calcium carbonate. Fossils are usually absent (references 2 and 4).

d. Some bituminous coal beds are present that are usually less than 1 foot in thickness; however, they are commonly intermixed with very thin shale seams. The presence of coal beds is indicative of swampy conditions that occurred during deposition (references 2 and 4).

2. Bedrock Landscape Development. The resistant limestone formations, whose surface expression forms a series of northeast-southwest trending bench-like ridges, influence development of the dissected landscape in areas where bedrock crops out. The limestone which commonly caps the ridges, forms steep to almost vertical slopes near the top. The

shale and sandstone, which are less resistant to erosion, form gentle slopes, which commonly result in rolling topography between these ridges. In general, the ridges exhibit steep eastward-facing slopes and gentle westward-facing slopes (references 2 and 4).

3. Unconsolidated Deposits.

a. Deposits of glacial drift occur in the area, either as isolated, or extensive deposits. These deposits are composed of a heterogeneous mixture of clay, silt, sand, gravel, and boulders deposited by glacial ice and/or associated meltwater (references 2 and 4).

b. Glacially derived wind-blown deposits, called loess, are also present in some areas. They are brown to reddish-brown in color. These loess deposits are generally composed of silt, but also may be sandy. A veneer of loess mantles much of the upland area in the Kansas City area, and significant thicknesses (i.e., ranging from a few feet to as much as 60 feet) occur along the bluffs of the Missouri River (references 2 and 4).

c. Alluvial deposits, also known as valley-fill deposits, which are composed of sand and gravel, occur locally where periglacial streams eroded and refilled channels in the drift at various times during the glacial period. These alluvial deposits underlie the flood plains and adjacent terraces of the Missouri and Kansas Rivers, and the valleys of tributary streams. Many of the former valleys or channels that were eroded in the bedrock and the glacial drift, do not coincide with the location of recent valleys in the surface of the upland plain. Because of the manner in which glacial drift extended over the area covering the valleys and many of the ridges, thicknesses differ from several feet to as much as 160 feet. Buried stream valleys are known to exist in Wyandotte and other counties; however, information concerning their detailed location and character has not been mapped. Small buried stream valleys may be beneficial in terms of drainage and water supply, or they may be detrimental when discovered unexpectedly during a construction project (references 2 and 4).

(1) Alluvium occurring in the Missouri and Kansas River valleys, which has thick deposits of a broad variety of materials and a wide range in grain sizes, represents drainage from very large basins over a long period of geologic time. The alluvium consists predominantly of sand and gravel in the lower part and grades upward to mostly silt and clay in the upper few feet. Thickness of the alluvium may be as much as 100 feet in the Kansas River valley and 120 feet in the Missouri River valley (references 2 and 4).

(2) Alluvial deposits are present, which are commonly composed of silt and clay near the surface with much sand and gravel beneath the broad flood plains. Alluvium in the tributaries generally contains greater amounts of clay with layers of sand and gravel at the base. Terrace deposits are generally very clayey or silty (references 2 and 4).

E. Local Geology in the Immediate Area of the KCARNG Armory, the OMS-7, and the Parking Lot.

1. Table 1 shows a generalized description of the rocks exposed in the immediate Area of the KCARNG Armory, the OMS-7, and the parking lot.

2. Soils in the immediate area of the KCARNG Armory, the OMS-7, and the parking lot have been assigned to the Knox series which consist of deep, strongly sloping to steep, well-drained soils on uplands. These soils are in strongly dissected areas along the Missouri River. They formed in loess. The main part of the armory site is located on the Knox silt loam, with 7 to 12 percent slopes; and the southwestern portion is located on the Knox silt loam, with 12 to 18 percent slopes (reference 5).

3. The youngest deposits of Pleistocene age include the widespread loess. Loess is peculiar in its tendency to stand in vertical walls. The loess in this area commonly contains a high percentage of fine sand. The loess covering is thickest along the edge of the bluff of the Missouri River where in some places it attains a thickness of more than 50 feet. Back from the river, within a short distance, it quickly thins out, and becomes indistinguishable from the soil covering. Along the Kansas River, the loess is absent between Edwardsville and Bonner Springs on the north side of the river, probably having been removed there by erosion, because the loess is continuous along the south wall of the valley. An irregular layer of loess that covers the eastern part of Wyandotte County effectively hides the underlying formations in the vicinity of Kansas City. It is believed that the loess of this region has been derived from the river silt of the valley bottoms, deposited by the overloaded streams during the ice retreat and later blown by the wind onto the neighboring uplands. Loess was probably deposited in the area of the KCARNG Armory, the OMS-7, and the parking lot; however, it may not be present in the immediate area of the KCARNG Armory due to erosion or because of the previous construction activities, and/or the installation of the construction/demolition debris landfill (references 2 and 4).

4. The dissected, resistant limestones form distinct bench-like ridges in the immediate area of the KCARNG Armory, the OMS-7, and the parking lot. The Westerville, Drum, Iola, and Argentine Limestones (in ascending order) of the Kansas City Group (reference 2) form these ridges.

VI. FINDINGS AND DISCUSSION.

A. Reason for this Preliminary Assessment. This PA was required since the KCARNG Armory and its parking lot were listed on the EPA's Hazardous Waste Compliance Docket Number 8, published in October 1993. Under EPA policy, each facility included on the docket must complete a PA within 18 months of publication of the notice. The National

TABLE 1. GENERALIZED SECTION OF THE ROCKS IN THE IMMEDIATE AREA OF THE KANSAS CITY ARMY NATIONAL GUARD ARMORY, THE OMS-7, AND THE PARKING LOT (Adapted from pages 162 and 163 of reference 2)

Quaternary System:	Thickness in feet.
Pleistocene Epoch:	
Loess, fine, locally arenaceous, clayey, buff to red, wind-blown material	0-50 +/-
Pennsylvanian Period:	
Kansas City Group:	
Wyandotte Limestone:	
Argentine limestone member:	
Limestone, thin-bedded, whitish gray, cherty, buff and shaly below	25 +/-
Quindaro shale member:	
Shale, buff, limy	1 +/-
Frisbie limestone member:	
Limestone, bluish, blocky, even-bedded	2 +/-
Lane shale:	
Shale, argillaceous, bluish-gray to buff	25 +/-
Iola limestone:	
Raytown limestone member:	
Limestone, even-bedded, massive, dark-gray, large productids near the middle	6
Muncie Creek shale member:	
Shale, argillaceous, buff, with platy, carbonaceous layer at the middle	3
Paola limestone member:	
Limestone, bluish-gray, dense, even	1
Chanute shale:	
Shale, argillaceous, dark-gray, maroon layer near middle	12 +/-
Drum limestone:	
Limestone, thin-bedded, light-gray, locally cherty, with particular fossil species	10 +/-
Quivira shale:	
Shale, argillaceous, green to gray, carbonaceous near the middle . .	5 +/-
Westerville limestone:	
Limestone, drab, brown at top, upper layer of brown chert, locally underlain by oolite, or oolitic throughout, or hard, gray limestone and oolite	14 +/-

Guard Bureau (NGB) Environmental Resources Management Office sent a letter on 28 June 1993 to the Office of Federal Facilities Enforcement of the EPA stating that the KCARNG Armory, the OMS-7, and the parking lot are a State-owned small quantity generator, and therefore did not qualify for inclusion on the Federal Agency Hazardous Waste Compliance Docket. However, because the KCARNG Armory, the OMS-7, and the parking lot comprise a property of approximately 14 acres, which has been leased to the Citizens Military Committee of Wyandotte County, Kansas, the EPA has determined that the KCARNG Armory, the OMS-7, and the parking lot are a privately-owned, government-operated (POGO) small quantity generator (references 6 and 7).

B. Description of the Landfill Below the OMS-7 and the Parking Lot.

1. A flood occurred in 1951 that devastated the Kansas City metropolitan area. The debris, which was left on the banks and the floodplain of the Kansas River, was removed and landfilled at various low-lying sites within the highlands north of the Kansas River valley. Kansas City, Kansas previously owned the Kansas City armory site. The armory was built in 1955 on a limestone bluff directly adjacent to one of these construction/demolition debris landfill sites (references 8, 9, and 10).

2. During 1953 to 1963 the Owens-Corning Fiberglass Corporation used the landfill site as a dump for its process wastes. A large but unknown amount of waste fiberglass from the Owens-Corning Fiberglass Corporation factory was buried in this landfill. In addition, other authorized and possibly some unauthorized dumping took place.

a. Prior to the 1970s, municipal dumps and landfills were unregulated and were operated without the current environmental controls and regulations. Every 2 to 4 days, rocks, coal cinders, and dirt were used to cover the waste material. The City of Kansas City dumped the coal cinders which came from the local electric power plants. The landfill covers an area of about 5.5 acres west of the armory. The OMS-7, the blacktopped driveway, the parking lot, the fenced gravel-covered motor vehicle storage compound (also known as the bullpen), and the gravel-covered area north of the bullpen, are located above this old landfill. The landfill was located on the west face of the bluff in a hollow that was between 25 to 40 feet in depth (references 8, 9, and 10).

b. Numerous complaints concerning odors, and the seepage of leachate into a ravine located southwest of the landfill occurred during the operation of this landfill. As a result of these complaints, the Wyandotte County Health Department recommended in July 1958 that the landfill be closed and also that future disposal of material by the Owens-Corning Fiberglass Corporation be within a tight clay soil in a sanitary landfill. However, both recommendations were rejected by Kansas City officials. This particular landfill was closed in 1963, and covered with an unknown amount of local soils; however, the KCARNG Arsenal personnel later added 1 to 2 feet of packed gravel to the surface of this landfill. The landfill has approximately a 3:1 slope on the southern and western sides. The covered dump

is generally accessible to the public; however, the KCARNG motor vehicle storage compound, on a portion of the old landfill site, is fenced and locked after working hours (reference 10).

3. The operational history of the KCARNG Armory, the OMS-7, and the parking lot began when the armory and the adjacent OMS-7 were constructed in 1955. A brief environmental and operational historical description follows.

a. About 36 years ago the Mayor's office, the Kansas City commissioners, and the Heath Department had been besieged by public complaints of odors coming from the dump. On 8 July 1958, Mr. N.J. Burris, District Engineer, Kansas State Board of Heath, and two Sanitarians (Mr. Elmer Harmam and Mr. Jim Grohusky) with the Kansas City-Wyandotte County Health Department conducted an investigation of a nuisance condition at the landfill behind the KCARNG Armory (reference 11).

(1) Wastewater had been discharging from the landfill to a ravine, and the water had been flowing through an inhabited area to the Kansas River. This wastewater was dark brown in color and reportedly had a very offensive odor. Mr. Burris and the others visited the Owens-Corning Fiberglass plant, but were unable at that time to talk with anyone who could provide information about what was being discarded at this landfill (reference 11).

(2) On 9 July 1958, an individual with the Owens-Corning Fiberglass plant called Mr. N.J. Burris to inform him about the type of materials being discarded at this landfill. Other than fiberglass, the materials placed in this landfill were metal sludges, solvents, furnace refractory bricks, phenolic resins, paper, coal cinders from local coal-fired power generators, and asphalt. The materials used to bind the glass fibers together were 70 percent phenol formaldehyde and 30 percent Vinsol. Vinsol was a byproduct from turpentine manufacture. Pine tree stumps were used for turpentine production, and Vinsol was made from a residue of this process. In the manufacture of some of their products, about 4 ounces per square foot of asphalt was used to stick paper to the glass fibers. There was a lot of paper in the material discarded in the landfill. Each truck load was sprayed with water before leaving the plant, and reportedly the trucks were still dripping water when they reached the landfill (references 10 and 11).

b. In the late 1960s, the KCARNG Armory installed a concrete storm drainage system to control runoff and erosion from the parking lot and the motor vehicle storage compound (reference 10).

c. In March 1983, the field investigation team from Ecology and Environment, Inc. (E&E) conducted a preliminary assessment at this site. In June 1983, the Waste Management Branch of Region VII of the EPA recommended that the site be inspected and sampled for increased metal levels in the soil and for the presence of organic compounds such as phenols and formaldehyde (reference 10).

d. On 30 May 1984, E&E performed an onsite inspection of this site. No signs of erosion, settling, or slumping were noticed during this inspection (reference 10).

e. On 23 July 1984, E&E collected seven composited soil samples at a depth of 0-12 inches and three drainage sediment samples from on and offsite areas of the KCARNG site (Figure 3) (reference 10).

(1) Three of the seven composited soil samples collected by E&E were from the west facing slope, one sample from the southwest corner, and two samples from the south facing slope. The other is assumed to be a background sample collected from a field west of the site (Figure 3). E&E collected these composited soil samples from a depth of 0-12 inches. Most of these samples contained large amounts of coal cinder fill, which was used as a cover material. Table 2 lists the metals and Table 3 lists the base/neutral organics detected in these seven soil samples which were higher than the background sample (reference 10).

(2) E&E collected three sediment samples from the drainage area in the southwest corner of the site (Figure 3). They collected two sediment samples within an offsite intermittent creek which flows southwest of the site, i.e., one was the most upgradient creek sample, and the other sample was collected 1,000 feet downstream from the first site. E&E collected another sample from a storm water drainage ditch that intersects this creek about 500 feet south of the site (reference 10).

(3) No metals were detected at levels higher than background in any of the three drainage sediment samples. No acid extractable nor volatile organic compounds exceeded the detection limits in any of these sediment samples (reference 10).

(4) Table 4 lists the base/neutral extractable organic compounds detected at elevated levels (higher than background) in the sediment sample from the drainage ditch located in the southwest corner of the landfill. This drainage ditch receives leachate from the landfill. These base/neutral organic compounds may be attributable to breakdown of plastics dumped at the landfill.

f. During 14-17 August 1984, the Kansas Department of Health and Environment (KDHE) drilled four ground-water monitoring wells along the ridge southwest of the KCARNG Armory site (Figure 4). Representatives from E&E oversaw the drilling of these four wells. These wells were located to detect the presence of and migration of contaminants from the landfill. The water table depth ranged from about 4.5 to 30 feet below the surface; however, the water table depth differences were due to the topographic location of each well. Monitoring well No. 1 (MW-1) was originally designated as the background well, while monitoring wells Nos. 2, 3, and 4 [(MW-2), (MW-3), and (MW-4)] were located in the presumed downgradient direction in relation to the dump. MW-1 penetrated fiberglass fill material and therefore cannot be considered as a background well. Table 5 shows the locations, depths, and descriptions of the four wells at the KCARNG site (reference 10).

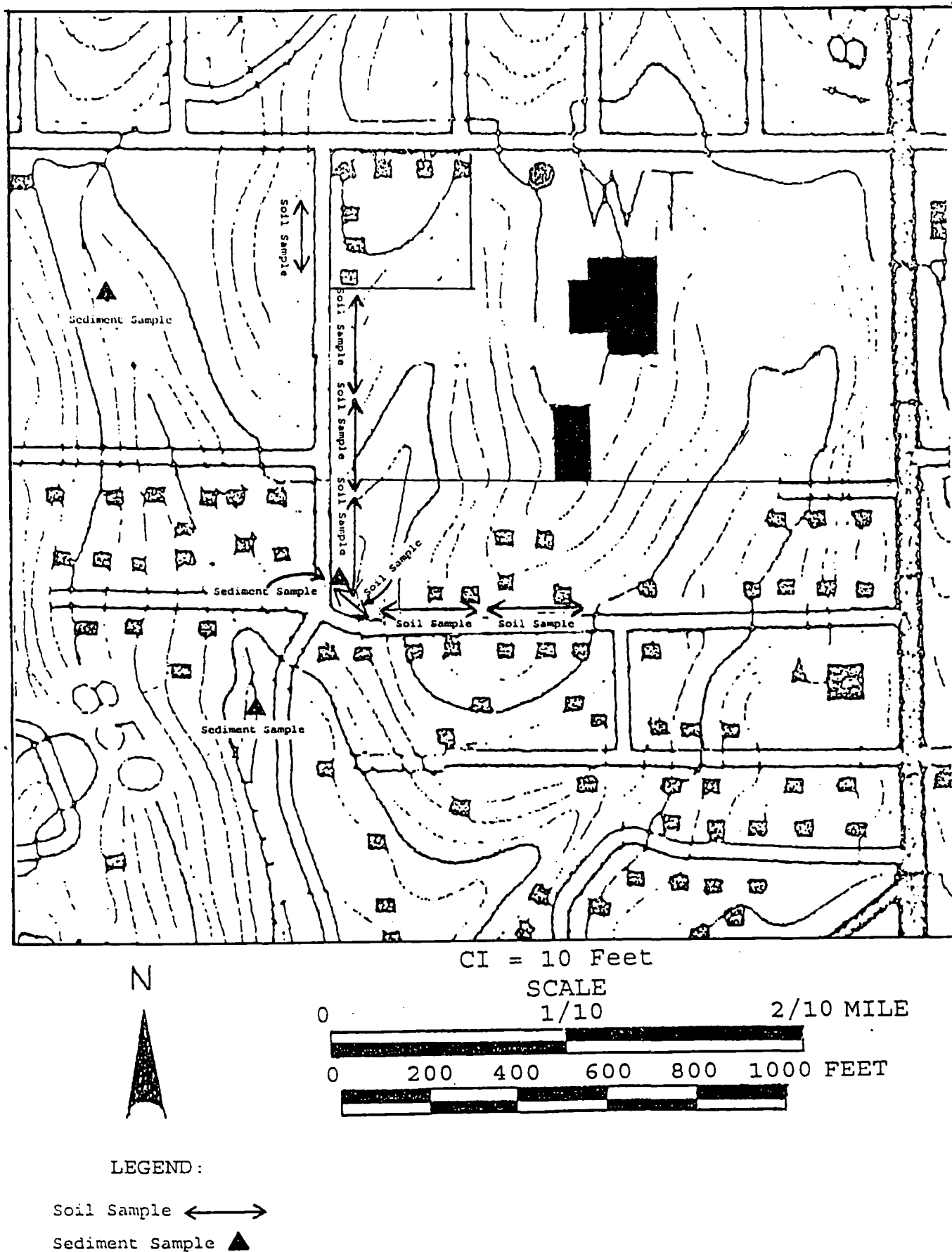


FIGURE 3. MAP SHOWING APPROXIMATE LOCATIONS OF SEVEN SOIL AND THREE DRAINAGE SEDIMENT SAMPLES

TABLE 2. METAL ANALYSES OF SEVEN SOIL SAMPLES COLLECTED ON 23 JULY 1984 IN MILLIGRAMS PER KILOGRAM (mg/kg) OR PARTS PER MILLION (ppm) BY THE FIELD INVESTIGATION TEAM, ECOLOGY AND ENVIRONMENT, INC.

Metal	Background	West Facing Slope			Southwest Corner	South Facing Slope	
Al	11,000	24,000	44,000	40,000	43,000	35,000	50,000
As	19	38	74	77	51	47	63
Ba	120	250	370	370	410	380	480
Cr	14	32	71	62	65	52	110
Fe	25,000	56,000	107,000	101,000	117,000	93,000	137,000
Pb	140	69	58	3,700	61	110	83
V	20	50	96	85	97	81	110

Adapted from reference 10.

TABLE 3. BASE/NEUTRAL ORGANIC ANALYSES OF SEVEN SOIL SAMPLES COLLECTED ON 23 JULY 1984 IN MICROGRAMS PER KILOGRAM ($\mu\text{g/kg}$) OR PARTS PER BILLION (ppb) BY THE FIELD INVESTIGATION TEAM, ECOLOGY AND ENVIRONMENT, INC.

Organic Compound	Background	West Facing Slopes			Southwest Corner	South Facing Slopes	
Fluoranthene	U	460.0	U	480.0	730.0	6,100.0	310
Bis(2-ethylhexyl) phthalate	370	2,600	5,100	U	460	U	U
Benzo(a)anthracene	U	570	U	610	720	5,700	U
Benzo(b)fluoranthene	U	610	U	540	660	5,400	U
Chrysene	U	570	U	610	720	5,700	U
Anthracene	U	U	U	470	460	4,600	U
Phenanthrene	U	U	U	470	460	4,600	U
Pyrene	U	370	U	520	610	5,300	240

U = Undetected

Adapted from reference 10.

TABLE 4. BASE/NEUTRAL EXTRACTABLE ORGANIC COMPOUNDS DETECTED IN SEDIMENT, COLLECTED BY THE FIELD INVESTIGATION TEAM, ECOLOGY AND ENVIRONMENT, INC. ON 23 JULY 1983, FROM THE DRAINAGE DITCH LOCATED IN THE SOUTHWEST CORNER OF THE LANDFILL, IN $\mu\text{g/kg}$ OR ppb (Adapted from reference 10)

Fluoranthene	1,100	Benzo(b)fluoranthene	890
Pyrene	900	Benzo(a)anthracene	900
Chrysene	900	Anthracene	520
Phenanthrene	520		

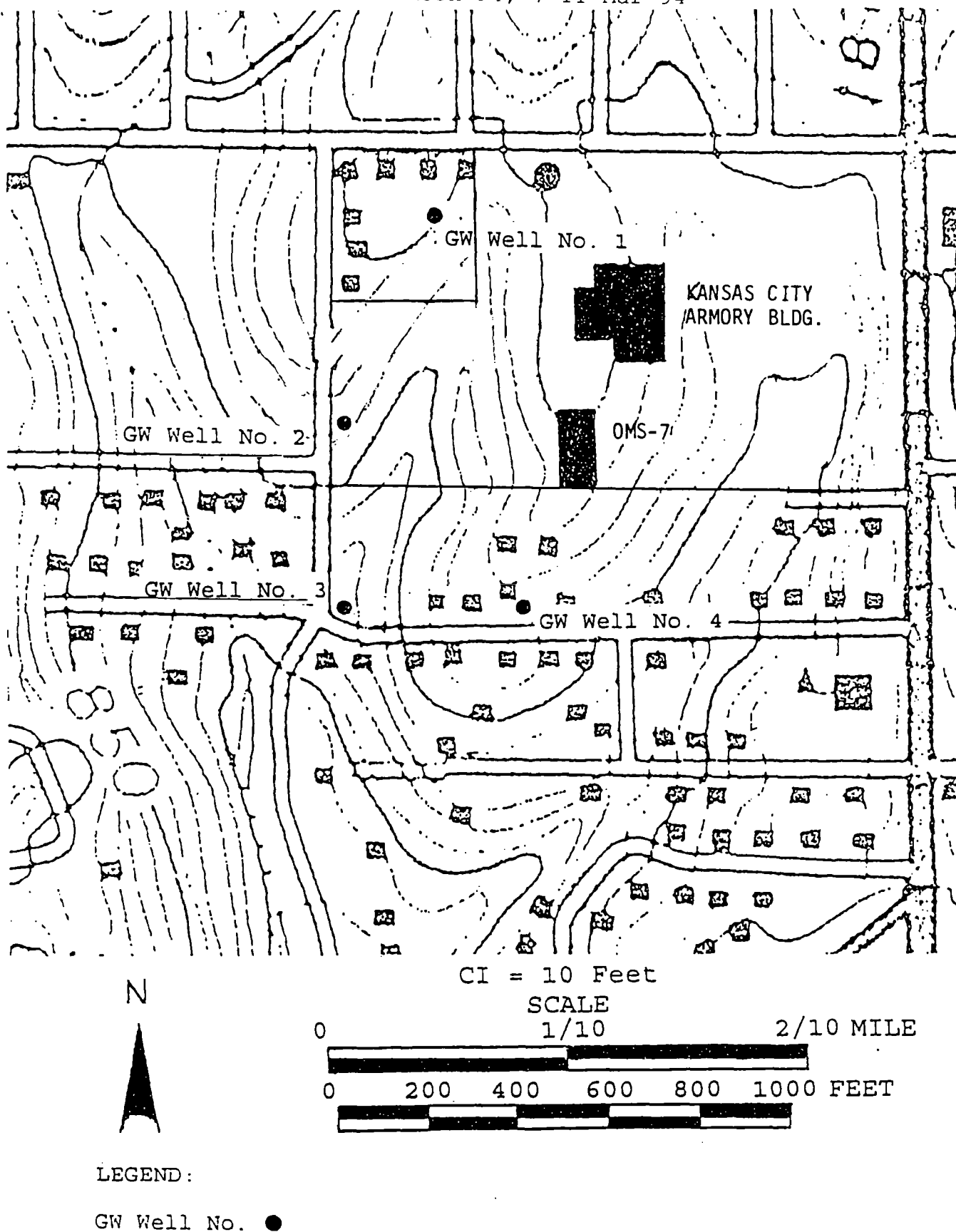


FIGURE 4. MAP SHOWING APPROXIMATE LOCATIONS OF EXISTING GROUND-WATER MONITORING WELLS AND THE BOUNDARIES OF THE KANSAS CITY ARMY NATIONAL GUARD SITE

TABLE 5. MONITORING WELL LOCATIONS, DEPTHS, AND DESCRIPTIONS

Well No.	Location	Depth of Well and Screen Interval	Well Log Description
MW-1	North side of landfill	42.5 feet Screen Depth 32 to 42 feet	0-33' Misc. rock, cinder fill and fiberglass fill, 33- 37', medium brown silty clay, 37-42.5', light brown silty clay.
MW-2	West side of landfill	42.5 feet Screen Depth 27 to 37 feet	0-7' Misc. rock, sand, and cinder fill, 7-42.5', medium blackish-brown silty clay. Auger refusal at 42.5' (rock or boulder).
MW-3	Southwest side of landfill	15.0 feet Screen Depth 5 to 15 feet	0-7' Misc. rock and black cinder fill, 7-14', loose, wet, black cinder fill, 14- 15', black silty clay.
MW-4	South side of landfill	39.0 feet Screen Depth 29 to 39 feet	0-7' Misc. rock, cinder and trash fill. 7-39', medium brown silty clay. Lost auger bit at 39'.

Adapted from reference 10.

(1) Following the development and subsequent purging of the monitoring wells, E&E collected ground-water samples on 22 August 1984 from wells Nos. MW-1 and MW-3. Wells Nos. MW-2 and MW-4 did not contain sufficient water to be sampled, perhaps due to the tight impermeable silty clay encountered. Both of these wells were reportedly checked in the fall of 1984 after rainy periods and they still did not contain more than 2 to 3 inches of water. The first round of ground-water samples reportedly were not analyzed within the EPA Region VII approved holding times; therefore, the E&E field investigation team resampled monitoring wells Nos. MW-1, MW-2, and MW-3 in April 1985 (reference 10).

(2) On 5 April 1985, E&E collected ground-water samples from monitoring wells Nos. MW-1, MW-2, MW-3, and MW-4. Well No. MW-1 was originally intended to be an upgradient background well; however, this well appears to be located on the north edge of the landfill. Well No. MW-2 is located along the western edge of the landfill. Well No. MW-3 is located at the southwest corner of the site directly downgradient from the landfill. Well No. MW-4 is located along the southern edge of the landfill (Figure 4) (reference 10).

(3) On 5 April 1985, E&E purged each monitoring well three well volumes 24 hours prior to sampling. E&E analyzed ground-water samples from wells Nos. MW-1 and MW-3 for total (unfiltered) and dissolved (filtered) metals (Table 6), volatile organic compounds (VOCs) (Table 7), and for base/neutral extractable organics (Table 8). Well No. MW-2 contained only enough water to collect one VOC sample. Well No. MW-4 contained only enough water to collect one VOC sample, and one sample for unfiltered metals analyses (reference 10).

(4) E&E also collected the leachate sample on 5 April 1985 near the southwest corner of the landfill. The leachate sample was not field filtered. Reportedly, a small intermittent spring occurred along the base of the limestone bluff in the northeast corner of the landfill. Flow from this spring enters the intermittent creek that is southwest of the landfill. This spring is buried under the existing landfill. It is suspected that this buried spring along with the southwest sloping surface of the landfill contributes to this leachate seepage (reference 10).

(5) The nine base/neutral extractable organics, which were detected in well No. MW-3, may be attributed to the breakdown of large quantities of plastic materials known to have been buried in the landfill. The concentrations were near the analytical detection limit. A wide range of metals were detected in wells Nos. MW-1, MW-3, and MW-4. The leachate seep sample contained elevated levels of all detected metals. The source of these metals may be attributed to the leaching of the coal cinder fill material and leaching of the metal sludges and other material disposed of in the landfill (reference 10).

(6) During the drilling of the four ground-monitoring wells, E&E collected split spoon samples from each well at depths from 0 to 24 inches, and from 24 to 48 inches from wells Nos. 1, 2, and 3. The investigation team analyzed the subsurface soil from the split spoons for VOCs (Table 9), base/neutral extractable organic compounds (Table 10), and for metals (Table 11) (reference 10).

(7) The ground-water monitoring wells were constructed with 2-inch diameter PVC pipe and screen; however, both these wells lacked the PVC protective caps on top of these wells. The steel protective casings were not locked with a padlock for security (reference 12).

TABLE 6. ANALYTICAL DATA FOR TOTAL AND DISSOLVED METALS IN GROUND-WATER SAMPLES AND A LEACHATE SEEP SAMPLE COLLECTED ON 5 APRIL 1985, IN MILLIGRAMS PER LITER (mg/L) OR ppm, BY THE FIELD INVESTIGATION TEAM, E&E, INC.

Metal	TOTAL METALS			DISSOLVED METALS		
	MW-1	MW-3	Leachate Sample	MW-1	MW-3	MW-4
Aluminum	19.0	12.0	140.0	0.027*	---	120.0
Antimony	0.056*+	0.079+	0.410+	---	0.034*+	0.064+
Arsenic	---	0.016	0.160+	---	0.011	0.030
Barium	0.260	1.500	12.0+	0.058*	0.980	2.200+
Beryllium	0.0028	---	0.025+	0.0011*	0.0011*	0.011+
Cadmium	---	---	0.065+	---	---	---
Calcium	230.0	36.0	1,800.0	240.0	25.0	280.0
Chromium	0.034	0.028	0.270+	---	0.0082*	0.160+
Cobalt	0.0042	0.0066*	0.190	---	---	0.093
Copper	0.039	0.041	0.570	0.014*	0.0088*	0.160
Iron	28.0	17.0	210.0	0.024*	0.700	360.0
Lead	---	0.096+	3.400+	---	---	0.220+
Magnesium	33.0	100.0	310.0	30.0	110.0	65.0
Manganese	0.380	0.360	15.0	0.210	0.068	15.0
Mercury	---	0.0008	0.0018	0.0003	---	0.0004
Nickel	0.045	0.031*	0.480+	---	0.010*	0.240+
Potassium	4.5	74.0	170.0	0.530*	74.0	16.0
Sodium	51.0	1,000.0	1,300.0	53.0	1,200.0	68.0
Vanadium	0.043	0.035	0.290	---	0.0071*	0.470
Zinc	---	---	3.500	---	---	0.450

--- = Values not shown are below the detection limit.

* The value indicated is below the quantitation limit but above the detection limit.

+ Exceeds the National Primary Drinking Water Regulations.

Adapted from reference 10.

TABLE 7. ANALYTICAL DATA FOR SEMIVOLATILES [PHENOLS AND POLYCYCLIC AROMATIC HYDROCARBONS (PAH) COMPOUNDS] IN GROUND-WATER SAMPLES COLLECTED ON 5 APRIL 1985 BY THE FIELD INVESTIGATION TEAM, E&E, INC. IN MICROGRAMS PER LITER ($\mu\text{g/L}$)

Compound	MW-1	MW-3	Leachate Sample	MW-2	MW-4
Phenol	--	--	0.014	--	--
4-Methylphenol	--	--	1.500	--	--
Fluorene	--	--	--	ND	ND
Phenanthrene	--	--	--	ND	ND
Anthracene	--	0.007*	--	ND	ND
Fluoranthene	--	0.032*	--	ND	ND
Pyrene	--	0.029*	--	ND	ND
Benzo(a)anthracene	--	0.016*	--	ND	ND
Bis(2-ethylhexyl)phthalate	--	0.010*	--	ND	ND
Benzo(b)fluoranthene	--	0.028*	--	ND	ND
Chrysene	--	0.017*	--	ND	ND
Benzo(a)pyrene	--	0.028*	--	ND	ND
Ideno(1,2,3,-cd)pyrene	--	0.010*	--	ND	ND
Benzo(g,h,i)perylene	--	--	--	ND	ND
Acenaphthene	--	--	--	ND	ND

--- = Values not shown are below the detection limit.

* The value indicated is below the quantitation limit but above the detection limit.

ND = Not Determined.

Note: The initial run of samples from well No. MW-3, a field blank, and the leachate sample yielded low surrogate recovery for the semivolatiles and were rerun during the EPA Region VII laboratory quality assurance and quality control (QA/QC). The surrogate recovery improved during the sample rerun.

Adapted from reference 10.

TABLE 8. ANALYTICAL DATA FOR VOCs IN GROUND-WATER SAMPLES COLLECTED ON 5 APRIL 1985 BY THE FIELD INVESTIGATION TEAM, E&E, INC. IN mg/L

Compound	MW-1	MW-2	Leachate Sample	MW-3	MW-4
Vinyl chloride	--	--	--	0.005*	--
Methylene chloride	0.004*	0.017	0.004*	0.002*	0.015
Tetrachloroethene	0.005+	--	--	--	0.003*

--- = Values not shown are below the detection limit.

* The value indicated is below the quantitation limit but above the detection limit.

+ Value is of unknown quality; approximate value.

Adopted from reference 10.

TABLE 9. VOLATILE ORGANIC ANALYTICAL RESULTS FROM ANALYSES OF SUBSURFACE SOIL SAMPLES (SPLIT SPOON SAMPLES) COLLECTED DURING 14-17 AUGUST 1984 BY THE FIELD INVESTIGATION TEAM, E&E, INC. FROM THE FOUR GROUND-WATER MONITORING WELLS, IN $\mu\text{g/kg}$ OR ppb

Well Number	MW-1	MW-1	MW-2	MW-2	MW-3	MW-3
Depth of Sample	0-2'	2-4'	0-2'	2-4'	0-2'	2-4'
Methylene chloride	270	270	210	260	61	110
Acetone	17	440	---	---	---	---
Carbon disulfide	13	440	39	47	34	44
2-Butanone	18	230	49	---	63	---
Trichloroethene	20	48	20	25	---	---
Toluene	12	120	---	---	---	---

These volatile organics were detected at levels higher than background; however, these values are approximate due to the exceedance of the holding time.

TABLE 10. BASE/NEUTRAL ANALYTICAL RESULTS FROM ANALYSES OF
SUBSURFACE SOIL SAMPLES (SPLIT SPOON SAMPLES) COLLECTED
DURING 14-17 AUGUST 1984 BY THE FIELD INVESTIGATION TEAM,
E&E, INC. FROM TWO GROUND-WATER MONITORING WELLS IN
 $\mu\text{g/kg}$ OR ppb

Well Number Compound	MW-1 2-4'	MW-2 2-4'
Phenanthrene	---	1,900
Anthracene	---	490
Benzo(a)anthracene	---	1,800
Bis(2-ethylhexyl)phthalate	5,000	750
Benzo(b)fluoranthene	---	2,700
Benzo(a)pyrene	---	1,900
Ideno(1,2,3-cd)pyrene	---	600
Benzo(g,h,i)perylene	---	490
Fluoranthene	---	10,000
Chrysene	---	1,800

These base/neutral organics were detected at levels higher than background; however, these values are approximate due to the exceedance of the holding time.

TABLE 11. ANALYTICAL RESULTS OF METALS FROM SUBSURFACE SOIL SAMPLES (SPLIT SPOON SAMPLES) COLLECTED DURING 14-17 AUGUST 1984 BY THE FIELD INVESTIGATION TEAM, E&E, INC. FROM THREE GROUND-WATER MONITORING WELLS IN $\mu\text{g/Kg}$ OR ppb

Well No.	MW-1	MW-1	MW-2	MW-2	MW-3	MW-3
Depth	0-2'	2-4'	0-2'	2-4'	0-2'	2-4'
Aluminum	9.7	16.0	40.0	51.0	48.0	43.0
Arsenic	0.0076	0.010	0.024	0.027	0.029	0.027
Barium	0.110	0.270	0.290	0.330	0.360	0.460
Cadmium	0.0015	0.0016	0.029	0.0036	0.0037	0.003
Chromium	0.010	0.059	0.054	0.068	0.063	0.060
Cobalt	0.0055	---	0.026	0.034	0.029	0.027
Copper	0.014	0.0033	0.050	0.063	0.057	0.053
Iron	12.0	1.6	112.0	147.0	136.0	120.0
Lead	0.03	0.025	0.052	0.069	0.071	0.064
Manganese	0.19	0.07	0.60	0.78	0.69	0.67
Selenium	0.0008	0.0023	0.0045	0.014	0.0028	0.0032
Tin	0.003	0.022	0.017	0.015	0.019	0.019
Vanadium	0.022	0.011	0.077	0.10	0.097	0.092

--- = Values not shown were below the detection limit.

The elevated metal levels may be due to the coal cinder fill material that was used as a cover and fill soil.

g. On 17 November 1986, Ms. Debra Agapito and Mr. Paul Belt with KDHE, conducted a hydrologic survey of the drainage area at the KCARNG Armory site. Their visual observations indicated that landfill seepage occurred at the southwest corner of the KCARNG Armory site. The two major intermittent or ephemeral tributaries branch to the northeast and northwest. The staff noted that the northwest tributary stream flowed once the seepage was discharged through a storm sewer pipe. The tributary located directly west and approximately at the same elevation as the flowing tributary was dry. The armory parking area appears to serve as a localized recharge area. The nature of the construction of the construction/demolition debris landfill may have created a "bathtub" effect and probably is the source of the localized discharge (reference 12).

h. On 17 November 1986, Ms. Debra Agapito and Mr. Paul Belt with KDHE, collected ground-water samples from well No. MW-3, a leachate seep located near the southwest corner of the KCARNG Armory site, and a nearby creek during their hydrologic survey of the drainage

area at the KCARNG Armory site. The chemical analyses were for VOCs, which the KDHE laboratory analyzed. The analyses of water from MW-3 indicated that vinyl chloride was detected at 10.8 $\mu\text{g/L}$ or ppb, 1,1-dichloroethane was detected at 0.7 $\mu\text{g/L}$, Trans or Cis-1,2-dichloroethylene was detected at 0.5 $\mu\text{g/L}$, and benzene was detected at 7.7 $\mu\text{g/L}$. The leachate seep analyses detected vinyl chloride at 1.3 $\mu\text{g/L}$, 1,1-dichloroethane at 1.7 $\mu\text{g/L}$, Trans or Cis-1,2-dichloroethylene at 0.9 $\mu\text{g/L}$, and benzene at 22.3 $\mu\text{g/L}$. There were no VOCs detected in the sample from the creek. The KDHE stated on 14 January 1987 that any ground-water samples collected from these two observation wells would be suspect, since visual inspection of these three wells indicated that they were poorly constructed. The steel protective casings of these two ground-water observation wells did not have padlocks for locking these wells on 17 November 1986 in order to protect the integrity of the wells, and on 8 March 1994 there were no padlocks or hasps on these wells (reference 12).

i. On 14 January 1987 a KDHE representative concluded that the construction/demolition debris landfill under the KCARNG Armory site is the source of the local leachate discharge. The KDHE seriously questioned if this dump site would have any influence on any domestic or public water supply wells to be identified from their records within a 1-mile radius from this landfill (reference 12).

j. On 18 May 1987 a representative from KDHE investigated a citizens complaint from Mr. Keith Stanturf, who lived in the area, that a reddish-brown leachate seep was located near the intersection of Bunker Avenue and 22nd Street, behind the KCARNG Armory. In addition to the leachate seep, the complainant was concerned about the presence of weeds, brush, and trash in the area of the KCARNG Armory. On 30 July 1987, a KDHE representative collected a sample of this leachate seep, and the KDHE laboratory analyzed it for priority pollutant base/neutral and acid extractable organic compounds, and VOCs. There were no base/neutral or acid extractable organic compounds detected; however, a trace of hydrocarbons were indicated. The only VOC detected was 108 $\mu\text{g/L}$ of benzene. The KDHE collected another leachate sample from the storm drain near 22nd Street and Bunker Avenue. This VOC sample contained 4.4 $\mu\text{g/L}$ of vinyl chloride, 1.5 $\mu\text{g/L}$ of 1,1-dichloroethane, 1.1 $\mu\text{g/L}$ of trans- and/or cis-1,2-dichloroethylene, and 34.6 $\mu\text{g/L}$ of benzene (references 9 and 13).

k. On 18 June 1987 the complainant, who lived in the area, spoke with Mr. Jim Fischer, Environmental Technician with the KDHE, and advised him that he had a video tape of the area and was going to send a copy of the video to the Governor and also the local media. Mr. Fischer spoke with Mr. Chuck Linn, with the Bureau of Environmental Remediation of the KDHE, about the situation. Mr. Linn advised Mr. Fischer that the Bureau of Environmental Remediation was working on the site and the complaint should be forwarded to Mr. Rick Bean with the Bureau of Environmental Remediation (reference 13).

4. According to a Draft Final Report of a site inspection at the KSARNG Armory, prepared on 6 December 1985 by Mr. Ken Dunn, of E&E, Inc., for Region VII of the EPA, all residences within a 3-mile radius of the site used city supplied drinking water or had bottled drinking water delivered by truck. Apparently bottled water was used only for taste and concern

for safe water supply. Local ground water around the site was not known to be used in 1985; however, limited use of springs may have occurred in some areas of private residences. The nearest known ground-water wells were a 35-foot deep residential garden irrigation well located at 89 South 16th Street, about 3 blocks east of the KCARNG site, and five, 60- to 100-foot deep industrial wells located about 1- to 1.5-miles south of the KCARNG site. These five industrial wells were completed in the Kansas River alluvial aquifer (reference 10).

C. KDHE Hazardous Waste Compliance Inspection.

1. The KDHE representatives conducted a Hazardous Waste Compliance Inspection on 24 March 1988 at the KCARNG Armory to determine compliance with State and Federal hazardous waste regulations. The OMS-7 was staffed by nine KCARNG personnel who maintained about 150 vehicles. These personnel used Stoddard solvent in a 20-gallon parts cleaning vat and changed it when it became contaminated beyond use. They stored waste solvent in 55-gallon drums for pickup by a contract transporter, who took the waste to the Defense Reutilization and Marketing Office (DRMO) at Fort Riley, Kansas. The quantity of hazardous waste generated was more than 25 kilograms (about 55 pounds) but less than 1,000 kilograms (about 2,200 pounds) per month, which qualifies the KCARNG to be designated as a "Kansas Generator." Used oil was stored in a 300-gallon aboveground storage tank and in 55-gallon drums for transport to DRMO. The compliance inspection on 24 March 1988 revealed that at least three 55-gallon drums of hazardous waste were not properly marked, and documented weekly inspections of these hazardous waste containers were not conducted. The emergency response data were not posted, and regular training in hazardous waste handling was not being performed. In reply to the three shortcomings which were found during the compliance inspection: all hazardous waste containers have been properly marked, the inspections are conducted weekly and are being documented, the emergency response data has been posted, and hazardous waste training has been implemented (references 9, 14, and 15).

2. According to reference 9, the KCARNG OMS-7 discontinued vehicle painting operations as all painting (except for spot painting) is performed by the KSARNG in Topeka. The OMS-7 also contained a steam jenny. Trucks and engine parts were washed over a floor drain which flowed into a Publicly-Owned Treatment Works (POTW). A solvent/water mixture was previously used; however, this practice was discontinued and soap and water is used (reference 9).

3. According to reference 9, a variety of fuel additives and solvents were stored in small quantities in a locked 3- X 5-foot metal flammable storage shed located in the southwest corner of the fenced motor vehicle storage compound (Figure 2). The graveled area around the shed indicated signs of contamination (discolored gravel/soil and barren soil). A KDHE representative collected soil samples for chemical analysis; however, the record of this analysis was not found by the author. The KDHE representative observed an area of contamination in the southwest corner of the fenced compound (probable diesel fuel oil spill/leak). There was

evidence of offsite runoff toward a storm sewer immediately outside the fence. The KDHE representative collected another soil sample at this site; however, the record of this analysis was not found by the author (reference 9).

4. During the hazardous waste compliance inspection on 24 March 1988, the KDHE representative observed leachate flowing from the southwest side of the landfill down 22nd Street and into a storm sewer. The KDHE collected samples for chemical analysis and for heavy metals and VOCs analyses; however, the record of this analysis was not found by the author (reference 9).

5. According to reference 9, stoddard solvent is no longer used at the OMS-7. Since 1 January 1989, the Safety-Kleen Corporation has provided the solvents used (reference 9). The Safety Kleen Corporation usually provides a parts cleaning machine along with their product solution for parts cleaning. They also provide a regular servicing policy for their equipment.

D. Current Hazardous Waste Storage and Hazardous Waste Sources at the KCARNG Armory, the OMS-7, and the Parking Lot.

1. Hazardous Waste Storage Area.

a. A new concrete lined and bermed hazardous waste storage area is located in the northeast corner within the fenced gravel-covered motor vehicle storage compound (also known as the bullpen). The 55-gallon drums, which contain hazardous waste, are temporarily stored there. These drums contained used motor oil, diesel fuel, solvents, and antifreeze. This hazardous waste storage area has a metal roof to keep rain and snow off these drums. A small diameter pipe is located under the west side of the concrete berm to allow any precipitation to drain from the berm. The pipe has a valve to close the pipe after draining the precipitation, since there are no walls around this storage area.

b. On 28 January 1987, the Hazardous Waste Section, Bureau of Waste Management of the KDHE sent a letter to LTC William W. Vonderschmidt acknowledging the filing of a notification of hazardous waste activity form on 21 November 1986 for the KCARNG facility. The EPA identification number is KSD981708985, and the description of hazardous wastes is D001. These numbers must be included on all shipping manifests for shipping hazardous wastes; on all annual reports that generators of hazardous wastes must file with the State; on all applications for hazardous waste permits; and on all correspondence related to hazardous waste management activities (reference 16).

2. Hazardous Materials/Waste Inventory. On 22 September 1993, an inventory was compiled of the hazardous materials/waste at the OMS-7, KCARNG facility.

a. The hazardous materials on hand at that time were consistent with the maintenance operation. The products were being properly stored and labeled. Material Safety Data Sheets (MSDS) at that time were not available for three of the four hazardous materials inventoried.

For methanol, NSN: 6810-00-567-3608, the MSDS was available; however, for sealing compound, NSN: 8000-00-180-6222, catalyst compound, NSN: 8010-00-082-1714, and alcohol, NSN: 6810-00-201-0907, the MSDS were not available on 22 September 1993.

b. The hazardous waste inventory on 22 September 1993 included M8 Alarm Kits with silver nitrate in a 55-gallon drum, mercury batteries in a 15-gallon drum, and lithium batteries in a 15-gallon drum.

E. Underground Storage Tanks (USTs).

1. On 31 December 1985 there were two steel 2,000-gallon USTs (tanks Nos. 1 and 2), and one steel 300-gallon UST (tank No. 3) reportedly in active use, located in the northeast corner of the bullpen (Figure 2). Tank No. 1 was filled with motor gasoline (MOGAS) and tank No. 2 was filled with diesel. Tank No. 3 was used for the storage of used motor oil. ~~Tank No. 3~~ Tanks Nos. 1 and 2 were painted on the inside with asphaltic paint for internal protection. Tank No. 3 had no internal paint. All the piping was bare steel. On 31 December 1985, tank No. 1 reportedly was 29 years old, tank No. 2 reportedly was 18 years old, and tank No. 3 reportedly was 30 years old (reference 17).

2. On 26 May 1988, the 32-year old, 2,000-gallon UST, which contained gasoline, was removed from the KCARNG facility. It was believed that this tank had been punctured in the process of working on a water line as water was found in the UST. When this tank was removed there was no evidence of a puncture hole in the tank; therefore, there was no soil contamination at this site. The petroleum products in the tank were removed and the contractor disposed of the tank. An estimated amount of 15 to 20 feet of Peoria loess overlies the limestone shale sequence of the Wyandote limestone. The area is highly dissected, and it was difficult to determine whether the ground under the tank was natural or fill material (references 18 and 19).

3. On 27 May 1988 a single-walled, 2,000-gallon galvanized steel UST, was installed at the KCARNG facility (UST No. 27443-002). This UST which contained gasoline had no internal protection other than being galvanized; however, it was equipped with zinc anodes for some cathodic external protection. This UST had a PVC observation tube, and the UST was backfilled with sand. It was anchored by cable with four eyebolts mounted on a concrete slab with an 8-inch concrete curb on all four sides (references 18 and 20).

4. The above mentioned single-walled, 2,000-gallon galvanized steel UST that contained MOGAS and later was used as a diesel storage tank was removed on 3 November 1993. This tank reportedly was in good condition; however, during filling operations, fuel may have been spilled resulting in some soil contamination around the cement platform supporting the tank. The contaminated soil (i.e., 40 cubic yards) from the tank basin around the fill pipe and near and around the concrete pad at base of the tank excavation was removed and placed in a remote area for aeration. The remaining soil is within KDHE soil standards (references 21 and 22).

5. The author found no data concerning the removal of the other two USTs; however, the other 2,000-gallon and the 300-gallon USTs were reportedly removed (reference personal communication with Mr. Sam Mryyan, Environmental Engineer with the KSARNG in Topeka, Kansas).

F. Asbestos.

1. According to reference 23, the pipe insulation near the OMS-7 office door contains 4 percent chrysotile. The asbestos reportedly was below the detectable limits (0.001 fibers per cubic centimeters of air). It was not friable at the time of sampling (1990) but the National Guard Bureau Industrial Hygienist reported that the pipe insulation needs to be periodically evaluated (reference 23).

2. According to reference 23, the pipe insulation in the boiler room at the KCARNG Armory contained 63 percent chrysotile, which was moderately friable with uncontrolled access (reference 23).

3. The plenum above the dining room contained wall board material with no asbestos (reference 23).

4. Loose material on the floor of plenum contained 47 percent chrysotile, which was highly friable. Fibers can easily be distributed throughout the armory ventilation and heating systems (reference 23).

5. The heat exchange system in the plenum wall was extremely dirty and was probably not functional. Building energy efficiency could probably be considerably increased with a proper maintenance program. The access door to the plenum was open and acted as the air source for the ventilation system. The air bypassed the heat exchanger when the door was open (reference 23).

6. Dry wall plenum contained no asbestos (reference 23).

7. The pipe insulation in the hall contained 63 percent chrysotile. It was covered but needs periodic inspection (reference 23).

8. The ceiling tile did not contain asbestos (reference 23).

9. One of the recommendations made in reference 23 was to remove all asbestos materials in the plenum at the Kansas City Armory. Conditions exist within the KCARNG that has allowed personnel to become exposed to measurable levels of asbestos fibers. No information was found that any further asbestos inspection or asbestos remediation had occurred since 1990 (reference 23).

10. An assessment of all known and suspected friable and nonfriable asbestos needs to be performed according to Chapter 10 of Army Regulation (AR) 200-1 update (dated 23 April 1990) (reference 24).

11. A comprehensive and effective asbestos management program and plan needs to be established following Department of the Army (DA) guidance (reference 24).

12. According to reference 24, all applicable Federal, State, local, and/or DA regulations relative to asbestos management and/or remediation will have to be complied with (reference 24).

G. Lead Found in the Indoor Firing Range.

1. An indoor firing range is located on the west side of the basement beginning at the southwest corner of the KCARNG Armory; however, it apparently is no longer used. This firing range is about 123 feet long and 25 feet wide. The bullet trap sand pit is located at the north end. Ten wipe samples and two bullet trap sand samples for total lead were collected from the indoor firing range and/or from the range traps on 9 November 1993, by Mr. Sam Myrran, Environmental Engineer, from the State Headquarters of the KSARNG in Topeka, Kansas. A private contractor (M.D. Chemical and Testing Company, Inc., of Topeka, Kansas) analyzed these wipe samples. The method of preparation for the analysis was EPA Method 3050, Acid Digestion of Sediments, Sludges, and Soils. The samples were analyzed using EPA Method 7420, Atomic Absorption, Direct Aspiration (reference 25).

2. The 10 wipe sample analytical results for total lead ranged from 84 to 5,240 micrograms per square foot ($\mu\text{g}/\text{sq. ft.}$). The average amount of total lead in the 10 wipe samples was 1,406 $\mu\text{g}/\text{sq. ft.}$ The two bullet trap sand samples contained 50,700 and 91,200 mg/kg or ppm of total lead. The high levels of lead may be due to the method of preparation for the analysis, i.e., acid digestion of the bullet trap sand which contained lead bullets and lead bullet fragments (references 25 and 26).

3. If the indoor firing range is no longer going to be used, the lead-containing bullet trap sand should be removed and the range site cleaned up. The lead-containing sand and any other equipment within the indoor firing range should be treated as hazardous waste. The lead bullet fragments could be recovered by sieving the bullet trap sand and the sand could be recycled and/or remediated. Care should be taken that the lead dust is not inhaled nor ingested. Care should also be taken to avoid skin contact with the lead-containing sand (references 24 and 26).

4. If the indoor firing range is to be used again, it should be remodeled and upgraded to prevent potential high levels of airborne lead dust. Proper hazardous waste characterization of the sand requires that the samples represent the waste sand as it will be at the time of disposal (references 25 and 26).

H. Arms Vault Seepage. The arms vault occupies seven separate rooms, each 25 feet long and about 9.5 feet wide, located along the west wall of the basement, beginning at the northwest corner. The KCARNG personnel reported that during the past few years, during the summer months, a small amount of a black, sulphurous smelling liquid has seeped into a few of the rooms of the arms vault close to the northwest corner of the building, along the base of the west basement wall. This liquid is cleaned up whenever it appears; however, no sampling of this liquid has ever been performed. This seep was probably from the old closed landfill, which is close to the west side of the armory.

VII. CONCLUSIONS.

A. Six soil samples collected in 23 July 1984 from the slopes of the landfill were analyzed for metals and for base/neutral organic compounds. Chemical analyses indicated that some metals and organic compounds generally contained higher analytical results than those detected in the background samples. In August 1994, the KDHE installed four ground-water monitoring wells in the vicinity of the KCARNG. Ground-water samples collected in 1985 were contaminated with metals and PAH compounds. Some of the metals detected exceeded the NPDWR (i.e., antimony, barium, beryllium, chromium, lead, and nickel). These elevated metal values were probably due to the use of a cover fill of coal cinders [paragraphs VIB3e(1), VIB3f, VIB3f(1) and Table 6, this report].

B. Although this preexisting landfill has a history of leachate problems, no further investigation by the Army is recommended at this time. The landfill was operated by the city and then by Owens-Corning Fiberglass Corporation, not by the Army. Because of its location, there is no possibility of constructing downgradient (and possibly upgradient) ground-water monitoring wells within the military boundary without penetrating the waste itself. If further investigation is deemed appropriate in the future, the approach must be coordinated among Region VII of the EPA, the KDHE, the Army National Guard, and other past and present landowners.

C. In 1985, all residences within a 3-mile radius of the KCARNG site either used city-supplied drinking water or used bottled drinking water; therefore, ground water was not used for drinking water. However, limited use of springs or ponds may have occurred in some areas. The nearest known ground-water well being used in 1985 was a 35-foot deep irrigation well located about 3 blocks east of the KCARNG site. Five, 60- to 100-foot deep industrial wells, completed in the Kansas River alluvial aquifer, are located south of the KCARNG site (paragraph VIB4, this report).

D. In the past, contaminated soil from small leaks and spills from the storage of fuel, fuel additives, and solvents occurred at or near a small metal storage cabinet in the southwest corner of the bullpen (paragraph VIC3, this report).

E. Two 2,000-gallon and one 300-gallon UST were located in the bullpen. Fuel was spilled around these USTs; however, the contaminated soils were removed when these three USTs were removed (paragraphs VIE4 and VIE5, this report).

F. Some friable asbestos was found around the heating pipes in the boiler room of the armory and also within the OMS-7. No information in the files was found to indicate that any further asbestos inspection or asbestos remediation had occurred since the last inspection in 1990 (paragraphs VIF1, VIF2, VIF4, VIF7, and VIF9, this report).

G. The indoor firing range and the bullet trap sand in the KCARNG, which apparently is no longer in use, contained lead and lead dust (paragraphs VIG1, VIG2, VIG3, and VIG4, this report).

H. No site investigation will be done by this Agency at this time. A decision will have to be reached among Region VII of the EPA, the KDHE, and the NGB as to what further action(s) needs to be accomplished at this site.

VIII. RECOMMENDATIONS.

A. Remove contaminated soil around the outdoor storage cabinets which exhibit evidence of past fuel and solvent leaks and/or spills. Using a backhoe, remove the contaminated soil to about a 1-foot depth. Check the remaining soil for staining, and if stains are still present remove more soil until the soil appears clean. Then test a few soil samples from the base of the excavation for VOCs and total petroleum hydrocarbons to document satisfactory remediation.

B. Perform an assessment of all known and suspected friable and nonfriable asbestos according to Chapter 10 of AR 200-1 (dated 23 April 1990).

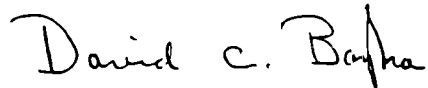
C. Establish a comprehensive and effective asbestos management program and plan following DA guidance.

D. Comply with all applicable Federal, State, local, and/or DA regulations relative to asbestos management and/or remediation.

E. Test the lead and lead dust from the indoor firing range for toxicity characteristics leaching procedures (TCLP) and for total lead, and if appropriate, the lead should be removed and treated as hazardous waste.

Preliminary Assessment No. 38-26-K33X-94, 7-11 Mar 94

F. Remodel and upgrade the indoor firing range, if it is to be used again, to prevent potential high levels of airborne lead dust.

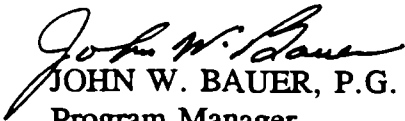


DAVID C. BAYHA, P.G.

Hydrologist

Waste Disposal Engineering Division

APPROVED:



JOHN W. BAUER, P.G.

Program Manager

Ground Water and Solid Waste

APPENDIX A

REFERENCES

1. Topographic Map of the Shawnee, Kansas 7.5 Minute Series Quadrangle, mapped, edited, and published by the U.S Geological Survey, 1964. Photo revised 1970 and 1975.
2. State Geological Survey of Kansas, Bulletin 21, Part I, The Geology of Johnson and Miami Counties, Kansas, by Norman D. Newell; and Part II, The Geology of Wyandotte County, Kansas, by John M. Jewett and Norman D. Newell, Kansas, 15 May 1935.
3. "Climatic Atlas of the United States," U.S. Department of Commerce, Environmental Science Services Administration, Environmental Data Service, June 1968, Reprinted by the National Oceanic and Atmospheric Administration, 1979.
4. Generalized Geologic Map of Topeka to Kansas City Corridor, Kansas, by John R. Ward and Howard G. O'Connor, Kansas Geological Survey Map M-15-A, 1983.
5. "Soil Survey of Leavenworth and Wyandotte Counties, Kansas," U.S. Department of Agriculture, Soil Conservation Service, in Cooperation with Kansas Agricultural Experiment Station, issued February 1977.
6. Letter from Chief, Installation Restoration Program Branch, Departments of the Army and the Air Force, National Guard Bureau to Ms. Augusta Wills, Office of Federal Facilities Enforcement, U.S Environmental Protection Agency, 28 June 1993.
7. Letter from Ms. Augusta Wills, Federal Facilities Docket Coordinator, U.S Environmental Protection Agency, to Chief, Installation Restoration Program Branch, Departments of the Army and the Air Force, National Guard Bureau, 12 October 1993.
8. Newspaper article entitled "Dump Vexes Neighbors" written by Ms. Regina Akers, Staff Writer, about Wyandotte County, published by the Kansas City Star, 5 July 1990.
9. Letter to LTC Richard F. Houser, Commanding Officer, Kansas Army National Guard from Mr. Jim Fischer Environmental Technician with the State of Kansas Department of Health and Environment, 31 March 1988.
10. "Draft Final Report, Site Inspection, Kansas Army National Guard Armory, Kansas City, Kansas, TDD #R-07-8303-12B," prepared by Ken Dunn, Field Investigation Team, Ecology and Environment, Inc., for Region VII EPA, 6 December 1985.

11. Memorandum for Record, Kansas State Board of Health, from Mr. N.J. Burris to Kansas City, Kansas (4.0) File, subject: Nuisance Conditions and Stream Pollution Resulting from the Dumping of Waste Materials From the Owens-Corning Fiberglass Company on a Site Behind the Kansas City Army National Guard Armory on South 18th Street, 11 July 1958.
12. Letter to Mr. Robert Morby, Chief Superfund Branch, Waste Management Division, U.S. Environmental Protection Agency, Kansas City, Kansas, from Mr. James A. Powers, Chief, Technical Services Division, Bureau of Environmental Remediation of the State of Kansas Department of Health and Environment, 14 January 1987.
13. Letter to Mr. Larry Knoche, State of Kansas Department of Health and Environment, Topeka, Kansas, from Ms. Lisa Larson, Northeast District Office, State of Kansas Department of Health and Environment, Lawrence, Kansas, subject: Leachate Seepage at 22nd and Bunker, Kansas City, Kansas. Legal Location: Section 17, Township 11 South, Range 24 East, Wyandotte County, Kansas, 24 June 1987.
14. Letter to Mr. Jim Fischer, Bureau of Waste Management of the State of Kansas Department of Health and Environment, Lawrence, Kansas, subject: Reply to Hazardous Waste Compliance Inspection, from LTC Richard F. Houser, Commander, Kansas City Army National Guard, 23 April 1988.
15. Kansas Administrative Regulations, Hazardous Waste Management, K.A.R. 28-31-1 through 28-31-14, Kansas Department of Health and Environment, Bureau of Air and Waste Management, 5 February 1990.
16. Letter to LTC William W. Vonderschmidt, Director of Facilities Engineering, Kansas Army National Guard in Topeka, Kansas. Concerning the Organizational Maintenance Shop No. 7 with the Kansas City Army National Guard, from Mr. John W. Mitchell, Hazardous Waste Section, Bureau of Waste Management of the State of Kansas Department of Health and Environment, Topeka, Kansas, acknowledging the filing of a Notification of Hazardous Waste Activity Form, 28 January 1987.
17. U.S. Environmental Protection Agency (EPA Form 7530-1), Notification for Underground Storage Tanks, located at the Kansas Army National Guard Organizational Maintenance Shop No. 7, at Kansas City, Kansas, 31 December 1985.
18. Permanent Tank Abandonment Permit, filed with the State of Kansas Department of Health and Environment, Bureau of Waste Management, Underground Storage Tank Section, Topeka, Kansas, reporting the installation of a 2,000-gallon steel underground storage tank, 26 May 1988.
19. Buried Tank Abandonment Assessment, 23 May 1988.

Preliminary Assessment No. 38-26-K33X-94, 7-11 Mar 94

20. 1993 UST Annual Registration reporting annual registration of a 2,000-gallon steel gasoline underground storage tank No. 27443-002, which was installed in 1988.
21. Kansas Department of Health and Environment, Buried Tank Leak Assessment Inspection, Project Code: 04105091C, OMS-7, Kansas City Army National Guard, 3 October 1993.
22. Memorandum For Record, AGKS-DOFE, 3 November 1993, subject: UST Removal OMS #7.
23. Memorandum for the Adjutant General of Kansas, from the National Guard Bureau, Industrial Hygiene, Buckley Air National Guard, Aurora, Colorado, subject: Industrial Hygiene Survey, 13 November 1990.
24. AR 200-1 Update, Environmental Protection and Enhancement, 23 April 1990.
25. Certificate of Two Analyses for Total Lead to Mr. Ron Cockran, Hazardous Waste Manager, Kansas Army National Guard in Topeka, Kansas, from M.D. Chemical and Testing Company, Inc., of Topeka, Kansas, subject: Sample Types: Wipes and Sand, Date Reported: 18 November 1993.
26. Letter, USAEHA, HSHB-ME-SE, 17 August 1988, subject: Protocol, Hazardous Waste Management Consultation No. 37-26-0180-88, Sampling and Characterization of Waste Sand From Indoor Firing Ranges, National Guard Bureau, June 1988.

APPENDIX B

PERSONNEL CONTACTED

KSARNG Representatives at the State Headquarters in Topeka, Kansas:

1. MAJ John K. Andrew II, Environmental Protection Specialist
2. Mr. Sam A. Mryyan, Environmental Engineer
3. Mr. T. Ronald Cockran, Hazardous Waste Manager

Representatives at the Kansas City Army National Guard Armory and OMS-7, Kansas City, Kansas:

1. LTC Craig W. Crane, Commander, 2nd 132nd Infantry
2. CPT James E Trafton, Facilities Manager
3. CW2 Mark A. Seman, Shop Foreman, OMS-7

Kansas Department of Health and Environment Representatives (KDHE) at Lawrence, Kansas:

1. Mr. Mostafa Kamal, District Engineer, Waste Management Program
2. Mr. James Fischer, Environmental Technician, Waste Management Program

Wyandotte County Health Department Representative at Kansas City, Kansas:

1. Mr. John R. Cotter, P.E., Director Environmental Health Services

Kansas Geological Survey Representative at the University of Kansas, Lawrence, Kansas:

1. Mr. Donald O. Whittemore, Environmental Geochemist, Geohydrology

Preliminary Assessment No. 38-26-K33X-94, 7-11 Mar 94

APPENDIX C

LATITUDE AND LONGITUDE CALCULATION WORKSHEET BY USE OF AN ENGINEER'S SCALE

The following information was copied from Appendix E, "Standard Operating Procedures to Determine Site Latitude and Longitude Coordinates," from "Guidance for Performing Preliminary Assessments Under CERCLA," United States Environmental Protection Agency, Hazardous Site Evaluation Division, Office of Emergency and Remedial Response, Office of Solid Waste and Emergency Response, Washington, DC 20460, EPA/540/G-91/013, September 1991.

1. STATEMENT OF PROBLEM

Location information is critical to the site investigation process. This Standard Operating Procedure (SOP) describes the minimum standard to which latitudinal and longitudinal measurements should be recorded and how to obtain measurements from topographic maps. The investigator should complete a worksheet and attach supporting documentation, which record measurements and provide computations for review.

The purpose of this SOP is to provide a method to measure latitude and longitude which is accurate and practical. The procedure uses linear measurement and interpolation, referred to as Linear Interpolation (LI) to measure latitude and longitude. Compared to other techniques, LI:

- Requires only a single ruler or scale
- Requires no extrapolation of tangents or perpendiculars
- Requires no conversions or calculations, when using a scale graduated in seconds
- Is easy to learn
- Can be easily reviewed
- Is accurate to 1 second (± 0.5)

2. SITE REFERENCE POINT

The investigator should determine the site's geographic coordinates of a specified reference point. EPA's June 1989 draft policy simply requires describing the reference point for a site (e.g., northeast corner of site, entrance to facility, point of discharge). The January 1990 revision states: "...latitude and longitude coordinates may be made in reference to any convenient aspect of a site..." The language was intentionally vague due to the potentially infinite range of site spatial characteristics.

Latitude and longitude determination relies on 7.5-minute topographic maps published by the U.S. Geological Survey (USGS). At the scale of these maps (1:24,000), the small black square used to identify a single family dwelling is a little less in width than 1 second of latitude; the latitude and longitude of a house can be accurately determined to 1 second. When the building, facility, site, etc., is larger in width than 1 second, the question becomes, "From where should I take the measurement?" In some cases, the site could encompass hundreds of square miles, and several degrees or minutes of latitude. To specify a pair of geographic coordinates for the site location, a reference point must be determined for each site on a map for the official record.

To specify a single point location, remember that both natural and man-made features can change with time, and contamination can be documented outside a facility boundary. Property lines, water bodies, and buildings are particularly vulnerable to change. Give priority to the following situations when determining site reference points:

- Point representing the approximate center of the area of greatest concern or a major source as chosen by the project officer in the Region most familiar with the site; or
- Location of largest permanent structure, identified to the corner being measured.

On a 7.5-minute topographic map, mark the boundaries of the site, the area encompassing waste sources, with a very sharp pencil. If the site is a single point or building, use that point. If the building is large, select a corner and describe it for later worksheets. If the site is larger than a single building, draw a center line along the long axis (longest part) of the site (curving or segmenting the line so the line is always centered within the site), and designate the midpoint of the line as the center of the site. Mark this spot in pencil keeping the dot or cross-hair as fine as possible.

Choose a permanent site reference point that is accessible to field verification. During the site reconnaissance, verify the point location relative to topographic and physical structures on the map. Coordinates of known point locations (e.g., landfills, impoundments, wells) can also be calculated and recorded.

3. EQUIPMENT

The only equipment required for LI is an original version of the scale template, the CoordinatorTM (see attached page), a fine mechanical pencil (0.3 or 0.5 mm), a large flat work surface, and the topographic map(s) containing the site. Mylar films of maps are preferable. Do not use folded or wrinkled field maps.

The accuracy of LI depends on several factors, specifically the accuracy of the map and measuring device, the width of the pencil, and the cartographic ability of the person making the measurements.

The accuracy of maps printed on paper is approximately 50 feet (1 millimeter map distance) due to paper shrinking or swelling in varying humidity, or by creases in the map. This error can be considerable at the 1:24,000 scale, but these problems can be overcome by using Mylar film versions of the USGS maps. Similarly, measuring tools can have different levels of precision. Do not use the Topo-AidTM, a map aid used in the past, which does not provide the 1-second precision now required by EPA.

A second area where precision can be lost is the pencil used to mark reference lines. The smaller the width of the scribe (or line drawn by the pencil), the greater the ability to align measurements to the ruler. If the width of the scribe is broader than the graduation marks on the ruler, precision cannot be greater than the width of the scribe or ruler calibration.

A third critical factor of accuracy is the cartographic ability of the measurer. There are basically two ways to measure latitude and longitude on maps. The first requires extrapolating data from the site reference point out to the map boundaries. This method requires moderate cartographic skill and accurate drafting supplies, and can magnify resulting errors in proportion to the map edge distance from the reference point. The second requires measuring data interpolated within known map reference points, thereby reducing drafting errors.

Methodologies that required drawing tangents from an unknown point on a map to the map boundary using straight-edges or right-triangles are no longer supported by EPA. The ability to align edges parallel to the map boundaries while extrapolating the tangent line is critical to the accuracy of the calculation. A difference of only a few millimeters will create coordinate errors of 1 or more seconds. Error will result from aligning the straight edge directly over the unknown point and not allowing for the width of the scribe while drawing the tangent line. Another way that locational error is introduced is by relying on other features inside the map -- such as straight roads, apparently straight survey lines, and section lines -- to extrapolate tangents.

4. PROCEDURE

4.1 DEFINING THE GRID

Nine 2.5-minute map grid cells make up a USGS 7.5-minute topographic map (scale 1:24,000). These nine grid cells are defined by 2.5-minute tic marks at the edges of the map and 2.5-minute cross-hairs within the map. Determine which of the nine 2.5-minute grid cells contains the site center or reference point. Depending on the location of the grid, you will be required to draw two, three, or four framing lines. All measurements will be made within this grid. To draw the lines, align a straight edge so the point of the pencil will intersect two of the 2.5-minute cross-hairs. Be sure that the edge is not directly over the cross-hairs or the width of the pencil will be offset and the framing line will not exactly intersect the two cross-hairs (see Figure 4-1).

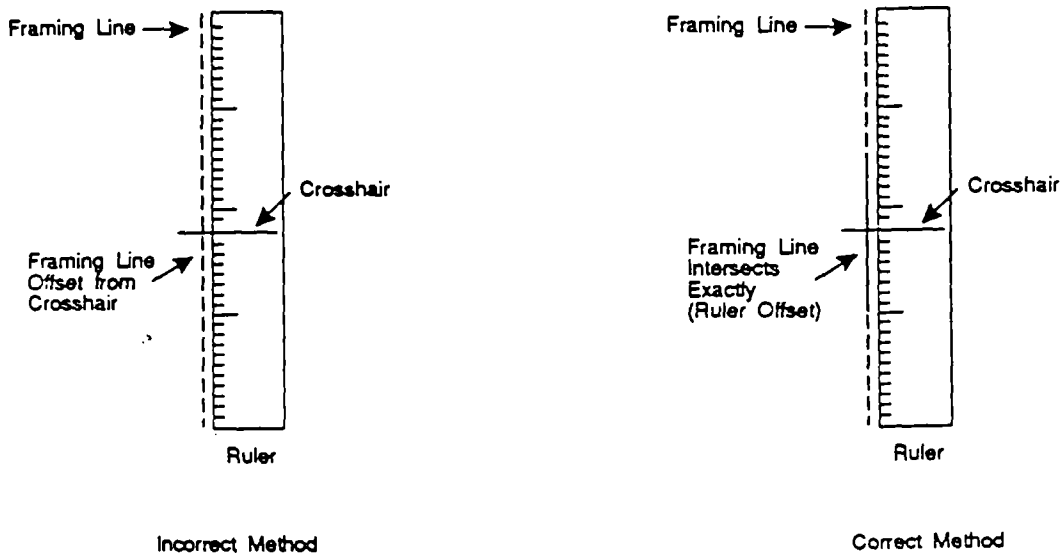


Figure 4-1. Aligning Framing Lines

Lightly draw the framing line, being careful to keep the pencil at an angle less than vertical, between 60 and 80 degrees. Strive to keep the pencil point against the straight edge at all times (see Figure 4-2).

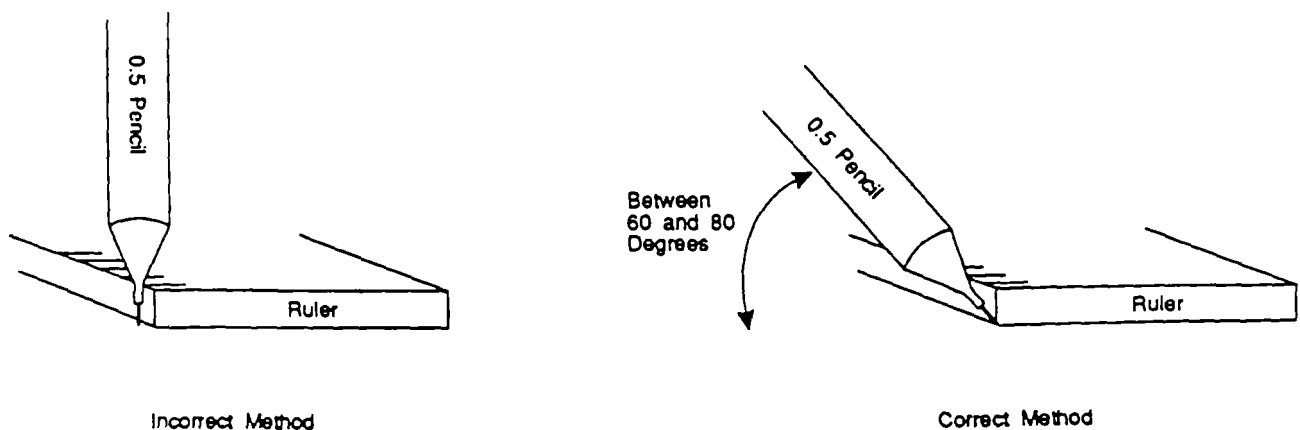


Figure 4-2. Scribing Framing Lines

After completing one of the lines, remove the straight edge and examine the line. If it does not intersect the center of the cross-hairs exactly on each end, erase the line completely and repeat the process.

NOTE: The corners of more recent 7.5 minute topographic maps may have dashed cross-hairs that differ slightly from the corners of the map. Measure from the corners of the map and not the dashed corner cross-hairs, a USGS correction for the 1983 datum. Most maps still rely on the 1927 datum. Consult the lower left legend of the map for more information on geodetic datum.

4.2 LI USING RULER GRADUATED IN SECONDS

The Coordinator™ is a clear template that is essentially eight custom rulers corresponding to the most common map scales. (The Coordinator™ can be obtained from drafting supply stores or 145 Cedar Hill Road, Bedford, NY 10506.) Other custom rulers can be used if the 1-second (or better) level of precision is maintained and documented.

Custom rulers are directly graduated in seconds of latitude. This is possible because map representations of latitude are essentially constant. One scale on the Coordinator™ fits precisely within a 2.5 minute arc of latitude on a 7.5 minute quadrangle map. By laying the scale over the site location precisely between the scribed latitude lines, latitude is read directly off the scale and added to the latitude of the lower line. With scale graduations in seconds, the accuracy of latitude to 1.0 second is ensured through direct measurement and interpolation. Directly measuring seconds prevents errors caused by conversion and ratio calculations.

Measuring Latitude Using a Custom Ruler (Coordinator™)

1. Set out Coordinator™ 1:24,000 scale and map with the site center or reference point identified.
2. Draw 2.5-minute framing lines around the grid with the site center or reference point (see Section 4.1).
3. Fill out background information on latitude/longitude worksheet.
4. Lay the scale on the map so that the bottom of the scale coincides with the bottom framing line and the top of the scale coincides with the top framing line (see Figure 4-3).
5. Move the scale laterally until it intersects the point to be measured. Be very careful to keep the top and bottom edges of the scale on the framing lines.
6. The scale has two sets of incremental designations; the left set begins at 30 seconds and the right set begins at 0 seconds. Use the scale that corresponds to the latitude number of the lower framing line. If it ends in 30 seconds, read along the left side. If it ends in 0 seconds, read along the right side.
7. Read up the scale from the lower framing line to the point to be measured. Note at each 00 second reading on the Coordinator Scale, add 1 minute to the beginning latitude number of the lower framing line. Record that number on the worksheet.

Measuring Longitude Using a Custom Ruler (Coordinator™)

Longitude is calculated using the same principle and scale as for latitude. The difference is that the ground distances of 2.5 minutes of latitude and longitude are not the same. If, however, you use the same scale and align your

divisions to those of the known longitude lines, the ratios and conversions become a linear measurement. Since the scale is exactly 2.5 minutes long, place each end of the scale on one of the longitude lines. Next, slide the scale up or down until it intersects the reference point. When the edges of the scale are precisely touching the longitude lines and the scale intersects the unknown point, read up the scale from right to left to measure the longitude.

1. Set up longitude framing lines as described in Section 4.1.
2. Lay the 1:24,000 scale on the map so that the bottom of the scale coincides with the right framing line and the top of the scale coincides with the left framing line (see Figure 4-3).
3. Move the scale up or down until it intersects the point to be measured. Be very careful to keep the top and bottom edges of the scale on the framing lines.
4. The scale has two sets of increments: the left set begins at 30 seconds and the right set begins at 0 seconds. Use the scale that corresponds to the longitude number of the right framing line. If it ends in 30 seconds, read along the left side. If it ends in 0 seconds, read along the right side.
5. Read the scale up from the right framing line to the point to be measured. Note at each 00" on the Coordinator™ scale, add 1 minute to the beginning longitude number of the lower framing line. Record that number on the worksheet.

Note: Be sure to identify starting latitude and longitude from the lower right-hand corner of the 2.5 minute grid. If it ends in 30 seconds (30"), read off the 30-second side on the scale; if it ends in 00 seconds (00"), read off the 00 side.

4.3 LI USING AN ENGINEER'S SCALE

Alternative equipment to determine latitude and longitude coordinates is an "engineer's scale." An engineer's scale is a multi-sided ruler containing series of graduations per inch corresponding to map scales. For the 1:24,000 topographic maps, use the 60 divisions per inch scale; on this scale 454 divisions equal to 2.5 minutes. Use the 0 as 00" and 454 as 2'30" and follow the alignment process of Section 4.2. Record the number of divisions on the ruler, divide by 454 and multiply the resultant by 150. The number is now in seconds and can be added to the starting latitude or longitude to get the coordinates of the site.

Measuring Latitude and Longitude Using an Engineer's Scale

1. Display the 1/60 engineer's scale and map with the site center or reference point site identified.
2. Draw 2.5-minute framing lines on the grid with the site center or reference point (see Section 4.1).
3. Fill out background information on the latitude/longitude worksheet.
4. For latitude: place the 1/60 scale on the map so that the bottom of the ruler coincides with the bottom framing line and 454 coincides with the top framing line (see Figure 4-3).

For longitude: place the scale on the map so that the bottom of the ruler coincides with the right framing line and 454 coincides with the left framing line (see Figure 4-3).

5. Move the scale laterally (for latitude) or vertically (for longitude) until the scale intersects the point to be measured. Be very careful to keep the 0 and 454 edges of the scale on the framing lines.
6. Record the number on the ruler where it intersects the point to be measured on the appropriate worksheet. Divide that number by 454 and multiply the resultant by 150. OR multiply the number by 0.3304. The number is now in seconds and can be added to the starting latitude or longitude of the grid to get the latitude or longitude coordinates of the site. Complete the worksheet.

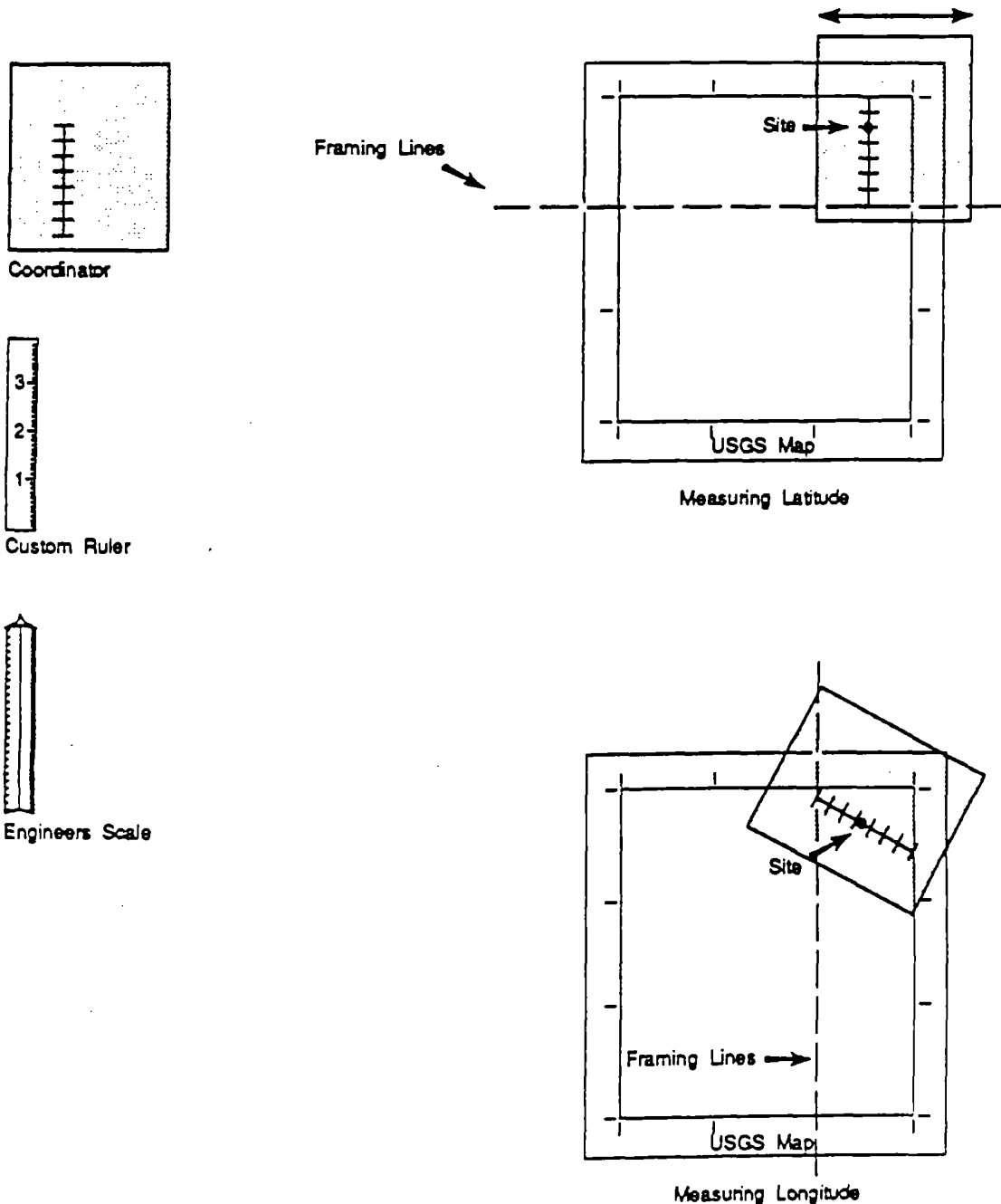


Figure 4-3. Determining Latitude and Longitude Using Linear Interpolation

5. QUALITY ASSURANCE

For QA purposes, a method must be developed to track how latitude and longitude coordinates have been verified and calculated. A datasheet (worksheet) is part of the required documentation for each PA. A completed worksheet allows a reviewer to follow the original steps and check the calculations. Completing each form is estimated to take approximately 10 minutes. Attach a complete 2.5-minute grid on a separate page with the site center or reference point clearly marked. All four corners of the grid must be clearly visible.

LATITUDE AND LONGITUDE CALCULATION WORKSHEET #1
LI USING CUSTOM RULER OR COORDINATOR™

SITE NAME: _____ CERCLIS #: _____

AKA: _____ SSID: _____

ADDRESS: _____

CITY: _____ STATE: _____ ZIP CODE: _____

SITE REFERENCE POINT: _____

USGS QUAD MAP NAME: _____ TOWNSHIP: _____ N/S RANGE: _____ E/W

SCALE: 1:24,000 MAP DATE: _____ SECTION: _____ 1/4 _____ 1/4 _____ 1/4

MAP DATUM: 1927 1983 (CIRCLE ONE) MERIDIAN: _____

COORDINATES FROM LOWER RIGHT (SOUTHEAST) CORNER OF 7.5' MAP (attach photocopy):

LONGITUDE: _____° _____' _____" LATITUDE: _____° _____' _____"

COORDINATES FROM LOWER RIGHT (SOUTHEAST) CORNER OF 2.5' GRID CELL:

LONGITUDE: _____° _____' _____" LATITUDE: _____° _____' _____"

CALCULATIONS: LATITUDE (7.5' QUADRANGLE MAP)

A) ALIGN THE BOTTOM OF THE SCALE WITH BOTTOM OF GRID. ALIGN THE TOP OF THE SCALE WITH THE TOP OF GRID. POSITION EDGE OF RULER OVER SITE REFERENCE POINT WHILE KEEPING TOP AND BOTTOM ALIGNED.

B) READ TICS ON RULER AT 1- OR 0.5-SECOND INTERVALS (INTERPOLATE).

C) EXPRESS IN MINUTES AND SECONDS (1' = 60"): _____' _____."

D) ADD TO STARTING LATITUDE: _____° _____' _____" + _____' _____" =

SITE LATITUDE: _____° _____' _____"

CALCULATIONS: LONGITUDE (7.5' QUADRANGLE MAP)

A) ALIGN THE BOTTOM OF THE SCALE WITH RIGHT SIDE OF GRID. ALIGN THE TOP OF THE SCALE WITH THE LEFT SIDE OF GRID. POSITION EDGE OF RULER OVER SITE REFERENCE POINT WHILE KEEPING TOP AND BOTTOM ALIGNED.

B) READ TICS ON RULER AT 1- or 0.5-SECOND INTERVALS. (INTERPOLATE)

C) EXPRESS IN MINUTES AND SECONDS (1' = 60"): _____' _____"

D) ADD TO STARTING LONGITUDE: _____° _____' _____" + _____' _____" =

SITE LONGITUDE: _____° _____' _____"

INVESTIGATOR: _____ DATE: _____

LATITUDE AND LONGITUDE CALCULATION WORKSHEET #2
LI USING ENGINEER'S SCALE (1/60)

SITE NAME: Kansas City Army National Guard Armory CERCLIS #: _____

AKA: _____ SSID: _____

ADDRESS: 100 South 20th Street

CITY: Kansas City STATE: Kansas ZIP CODE: 66102-5604

SITE REFERENCE POINT: Northeast corner of OMS-7

USGS QUAD MAP NAME: Shawnee TOWNSHIP: 11 N/S RANGE: 25 E/W

SCALE: 1:24,000 MAP DATE: 1964 SECTION: NE 1/4 NE 1/4 NE 1/4

MAP DATUM: (1927) 1983 (CIRCLE ONE) MERIDIAN: _____
(Photorevised 1970 and 1975)

COORDINATES FROM LOWER RIGHT (SOUTHEAST) CORNER OF 7.5' MAP (attach photocopy):

LONGITUDE: 94° 37' 30" LATITUDE: 39° 00' 00"

COORDINATES FROM LOWER RIGHT (SOUTHEAST) CORNER OF 2.5' GRID CELL:

LONGITUDE: 94° 37' 30" LATITUDE: 39° 05' 00"

CALCULATIONS: LATITUDE (7.5' QUADRANGLE MAP)

A) NUMBER OF RULER GRADUATIONS FROM LATITUDE GRID LINE TO SITE REF POINT: 191

B) MULTIPLY (A) BY 0.3304 TO CONVERT TO SECONDS:

$$A \times 0.3304 = \underline{63.1} "$$

C) EXPRESS IN MINUTES AND SECONDS (1' = 60"): 01' 3.1"

D) ADD TO STARTING LATITUDE: 39° 05' 00." + 01' 3.1" =

SITE LATITUDE: 39° 06' 3.1"

CALCULATIONS: LONGITUDE (7.5' QUADRANGLE MAP)

A) NUMBER OF RULER GRADUATIONS FROM RIGHT LONGITUDE LINE TO SITE REF POINT: 290

B) MULTIPLY (A) BY 0.3304 TO CONVERT TO SECONDS:

$$A \times 0.3304 = \underline{95.8} "$$

C) EXPRESS IN MINUTES AND SECONDS (1' = 60"): 1' 35.8"

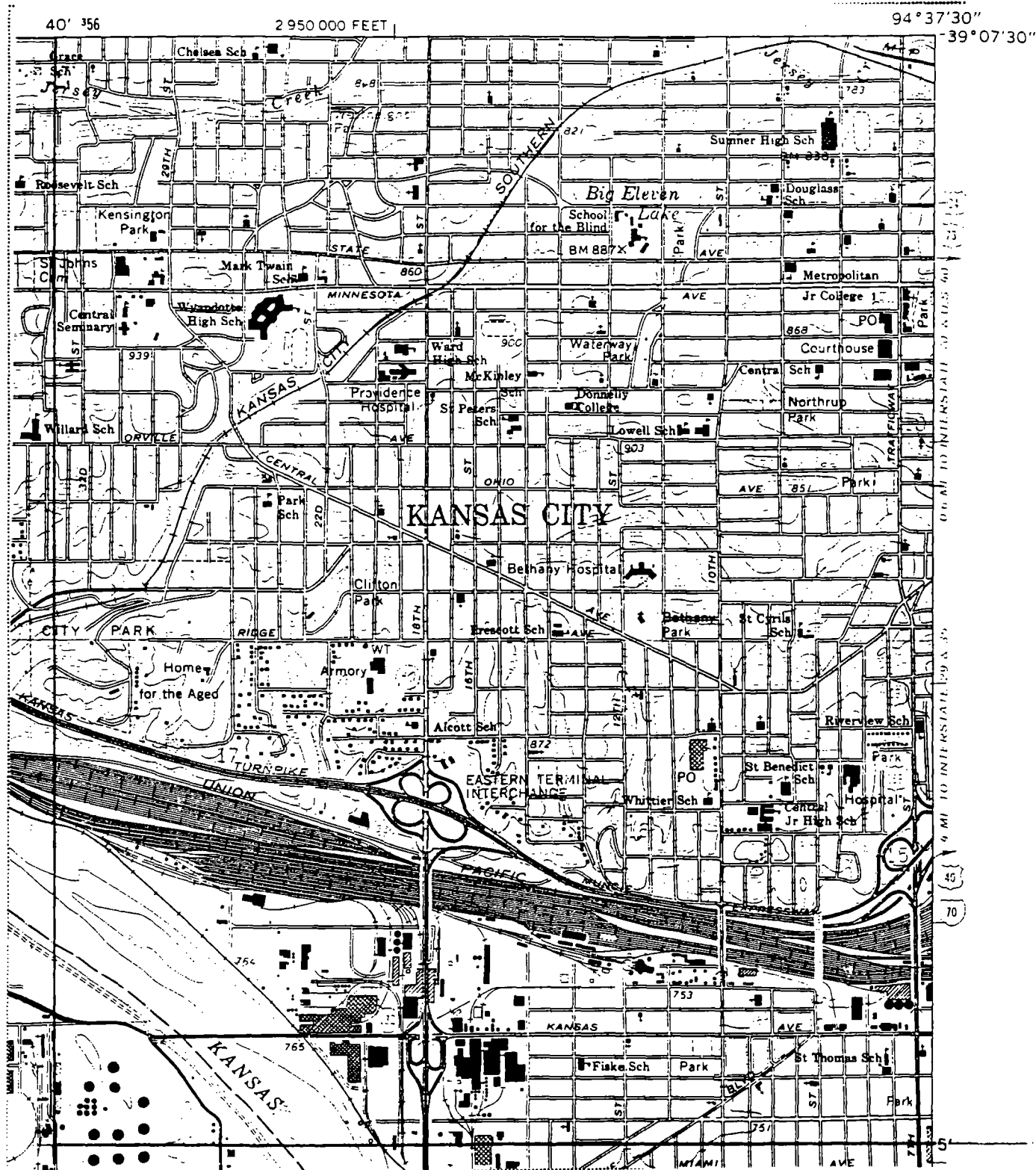
D) ADD TO STARTING LONGITUDE: 94° 37' 30.0" + 1' 35.8" =

SITE LONGITUDE: 94° 39' 5.8"

INVESTIGATOR: DAVID C. BAYHA DATE: 22 April 1994

David C. Bayha

SITE NAME: Kansas City Army National Guard Armory NUMBER: _____



TOPOGRAPHIC MAP QUADRANGLE NAME: SHAWNEE SCALE: 1:24,000

COORDINATES OF LOWER RIGHT-HAND CORNER OF 2.5-MINUTE GRID:

LATITUDE: 39° 05' 00" LONGITUDE: 94° 37' 30"
C-12

APPENDIX D
TECHNICAL ASSISTANCE

1. Requests for services should be directed through appropriate command channels of the requesting activity to Commander, U.S. Army Environmental Hygiene Agency, ATTN: HSHB-ME-SG, Aberdeen Proving Ground, MD 21010-5422, with an information copy furnished the Commander, U.S. Army Health Services Command, ATTN: HSCL-P, Fort Sam Houston, TX 78234-6000.

2. The numbered programs, and the program managers and their telephone numbers [DSN 584-XXXX or Commercial (410) 671-XXXX] are listed below for general support.

Program Number	Program Title	Program Manager	Telephone Number
11	Occupational Medicine Residency	LTC Deeter	4312
16	Pest Management	Mr. Wells	3613
17	Pesticide Risk Management	Dr. Evans	4131
24	Radio Frequency Radiation/Ultrasound	Mr. Hicks	4834
25	Laser/Optical Radiation	Dr. Sliney	3932
27	Industrial Health Physics	Mr. Edge	3526
28	Medical Health Physics	MAJ Matthews	3548
31	Water Supply Management	MAJ Rudolph	3919
32	Wastewater Management	Mr. Fifty	3816
37	Hazardous and Medical Waste	Mr. Resta	3651
38	Ground Water and Solid Waste	Mr. Bauer	2024
39	Health Risk Assessment	MAJ Lee	2953
42	Air Pollution Source Management	Mr. Daughdrill	3500
43	Ambient Air Quality Management	Mr. Guinivan	3500
51	Hearing Conservation	Dr. Ohlin	3797
52	Environmental Noise	Dr. Luz	3829
54	Special Industrial Hygiene Services	Ms. Doganiero	3928
55	Industrial Hygiene	MAJ Sheaffer	3118
56	Healthcare Hazards	CPT McKee	3040
57	Sanitation and Hygiene	MAJ McDevitt	2488
59	Industrial Hygiene Management	Ms. Monk	2439
63	Vision Conservation	LTC Thompson	2714
64	Occupational and Environmental Medicine	MAJ Gum	2714
65	Occupational Health Nursing	Dr. Dash	2714
66	Special Document Development	Ms. Kestler	4737
69	Health Hazard Assessment	LTC Murnyak	2925
74	Analytical Quality Assurance	CPT Lukey	3269
75	Toxicology Assessment	Mr. Weeks	3627
76	Organic Environmental Chemistry	Mr. Belkin	3739
78	Radiological/Inorganic Chemistry	Dr. Boldt	2619

3. Direct support is provided by:

USAEHA Activity - North, Fort George G. Meade, MD	LTC Phull, DSN 923-7403
USAEHA Activity - South, Fort McPherson, GA	LTC Broadwater, DSN 572-3332
USAEHA Activity - West, Fitzsimons AMC, CO	LTC Aiken, DSN 943-3737